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Integrated data processing in offices was studied to determine implications for the development of office occupations curriculums in public secondary schools and post-high school institutions offering less than baccalaureate degrees. Interviews were held with representatives of 285 businesses, teachers in 176 public high and post-high schools in the cities in which the businesses were located, and advanced planning executives of 13 computer manufacturers. Extensive findings include (1) It appears that jobs will become more complex rather than proliferate, (2) Little change will take place in computers in the next 3 to 10 years, (3) With the relative decrease in use of punched cards as input, the proportion of key punch and verifier operators will decrease, (4) Advances in software will be extensive in the next 3 to 10 years, and (5) There will be opportunities for programmers in systems analysis. Recommendations include: (1) inauguration of new programs and updating of existing ones, (2) training of greater numbers of teachers for the data processing field, and (3) summer experience in data processing for teachers. Recommended curriculums are included. (JK)

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SEPTEMBER, 1968

U. S. DEPARTMENT OF
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OFFICE OF EDUCATION
BUREAU OF RESEARCH

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

CURRICULAR IMPLICATIONS OF AUTOMATED DATA PROCESSING FOR EDUCATIONAL INSTITUTIONS

Project No. BR5-0144

Contract No. OE6-85-030

F. Kendrick Bangs, Principal Investigator

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September, 1968

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University of Colorado

Boulder, Colorado

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SUMMARY

The problem was to determine the implications of integrated data processing in offices for the preparation of office workers and the development of office occupations curriculums in public secondary and public post high school institutions offering less than baccalaureate degrees.

Specifically, the problem included:

1. The analysis of integrated data processing training programs in public education institutions.
2. A study of employees in the integrated data processing programs in selected business offices, as well as a study of needs as expressed by the data processing management personnel of these offices, to determine the common body of knowledge needed for entry into selected office occupations in data processing, adjustment to office occupations requiring knowledge or ability in data processing techniques, patterns of advancement in such office occupations, and job descriptions for seven major data processing job categories.
3. Determination of new and projected developments in data processing as forecasted by manufacturers and users of hardware and software and the influence of such developments on future job opportunities and training programs.

OBJECTIVES

The purpose of the study was to provide guidance for schools in evaluating existing programs and for establishing new programs in integrated data processing. The study compiled information to form the basis for modification of existing data processing programs and for establishment of new and flexible data processing curriculums in office occupation oriented educational programs. Occupational information about the data processing field for use of counselors was also obtained.

METHOD

The sample survey design utilizing interviews and questionnaires was used for this study. The design, using teams of trained interviewers, made possible the collection of data from schools and offices concurrently. The use of interviewers resulted in reaching nearly 100 per cent of the samples selected.

Interview schedules and questionnaires were developed and refined, tried out, and revised. The populations and samples were then selected. Since data processing equipment represents large capital investment, larger companies were the source of information for the problem. The population from which the sample of data processing equipment users was drawn was Dun and Bradstreet's 1963 Million Dollar Directory, which listed some 28,000 businesses with net worth of one million dollars or more. Use of the N.E.A. small-sample formula indicated that 285 businesses would constitute a reliable sample for a study of this kind. The study included 353 businesses.

The schools and teachers for the study were determined by the location of the businesses selected for the sample. Teachers in the public high schools in the city in which a business was located and public two-year post highs that offered programs in data processing were interviewed. A total of 176 school systems were included in the study.

A preliminary census of data processing offerings in the public educational institutions in the United States was obtained. A brief, one-page questionnaire, designed for optical scanning, was sent to all secondary and two-year post high schools in the United States. Over a 94 per cent return (10,278 questionnaires) was received. Analysis of these questionnaires resulted in a compilation of characteristics of existing data processing programs throughout the United States.

Fourteen interviewers, all business education teachers who taught at different educational levels from junior high school to four-year colleges, were selected and trained in the interviewing process. Specific training was given the interviewers on the use of the instruments designed for this study. The interviewers, working together in seven teams of two, spent three months collecting data throughout the 39 states in the sample.

Interviews were held with the advance planning executives of the computer manufacturers to determine what technological developments were being planned that would have any effect on the training of future employees in data processing.

Data collected from the interviews and questionnaires were coded and key punched into cards. Programs were written and run on the University computer. Analysis of the print-out data was made resulting in two recommended data processing curriculums, one for the high school and one for the two-year post high school institutions.

RESULTS

Analysis of the data collected from several sources (managers of data processing departments, employees in the data processing departments, teachers of data processing, and advance planning executives of the computer manufacturers) resulted in the development of a recommended data processing curriculum and course outline for the high school and for the two-year post high school. The recommended curriculums are as follows:

HIGH SCHOOL CURRICULUM IN DATA PROCESSING

9th Grade	**Units**
Mathematics	1
English	1
Social Science	1
Science	1
Typing	1
Physical Education	1

10th Grade	
Mathematics	1
English	1
Social Science	1
Science	1
Introduction to Data Processing	1/2
Physical Education	1
*	

11th Grade	
Advanced Algebra	1/2
English	1
Social Science	1
Computer Concepts and Systems Development	1
Bookkeeping	1
Physical Education	1

*Electives:
  Introduction to Business
  Consumer Economics

12th Grade	Units
Oral Communication	1/2
Written Communication	1/2
Business Organization and Management	1/2
Human Relations	1/2
Business and Office Procedures and Data Processing Applications	1
Physical Education	1
**	

**Elective:
Economics

Data Processing Courses

Among the specific topics and concepts to be included in the high school data processing courses, the following are recommended in the suggested courses:

Introduction to data processing (10th Grade-1/2 Unit)

1. History of records systems and manual data processing
2. Tabulating cards and equipment
    a. Card layout and design
    b. Equipment (purposes and operation, excluding panel wiring)
        (1) Key punch and verifier
        (2) Sorter
        (3) Interpreter
        (4) Reproducer
        (5) Accounting machine
        (6) Collator
3. Electronic computer logic
    a. Memory
    b. Input of data
    c. Calculation (arithmetic)
    d. Output
4. Flow charting
5. Computer operation (using a type and model of computer and a symbolic language for which the teacher and student have access)

Computer concepts and systems development (11th Grade-1 Unit)

1. Review of electronic digital computers and principles of data processing
2. Computer logic
3. Logic development through problem solving in general
4. Procedures development
5. Forms design
6. Computer languages (two languages: COBOL and one other, possibly Autocoder)
7. Computer business applications

Data processing applications (12th Grade-1/2 Unit)

(This course should be coordinated with Bookkeeping and Business and Office Procedures)

1. Systems analysis and design
2. Programming essentials
3. Report writing and analysis from computer printout
4. Gaming (simulation)
5. Laboratory (or on a co-op basis)

    a. Forms design
    b. Flow charting
    c. Writing the programs
    d. Operating computer
    e. Debugging
    f. Running of live work

POST HIGH SCHOOL CURRICULUM IN DATA PROCESSING*

FIRST YEAR

1st Semester:	Units
College Algebra	4
Written Communication	3
Accounting Principles	3
Introduction to Data Processing	4
Principles of Economics	3
	17

*Typewriting is considered a pre-requisite to this program.

FIRST YEAR (continued)

2nd Semester:

	Units
Data Processing Mathematics	3
Oral Communication	3
Accounting Principles	3
Business Conditions (or Contemporary Economic Problems)	3
Logic and Introduction to Systems Analysis	5
	17

SECOND YEAR

1st Semester:

Business Statistics	4
Psychology	3
Advanced Accounting	3
Introduction to Computer Programming	3
Data Processing Systems	3
	16

2nd Semester:

Principles of Management	3
Human Relations	3
Data Processing Applications and Practicum in Programming	5
Advanced Programming	3
	14

Data Processing Courses

Among the topics and concepts to be included in the post high school data processing courses, the following are recommended in the suggested courses:

Introduction to data processing (1st Year, 1st Semester-4 Units)

1. History of data processing
2. Principles of data processing

Introduction to data processing (continued)

3. Overview of unit records
    a. Key punch and verifier
    b. Sorter
    c. Interpreter
    d. Reproducer
    e. Accounting machine
    f. Collator
    g. Principles of panel wiring
4. Card layout and design
5. Electronic computer equipment
    a. Types
    b. Logic
6. Flow charting
7. Elements of programming
8. Laboratory in data processing equipment
9. Number systems

Logic and introduction to systems analysis (1st Year, 2nd Semester-5 Units)

1. Procedures development
2. Forms design (source document)
3. General flow charting
4. Program flow charting and block diagramming
5. Computer logic
6. Analysis of information network systems
7. Coding and condensing data

Introduction to computer programming (2nd Year, 1st Semester-3 Units)

1. Review of computer equipment
2. Principles and theory of digital computers
3. Programming essentials
4. Computer logic
5. Block diagramming
6. Coding and condensing data
7. Purposes and functions of different languages
8. Uses of symbolic languages
9. Central processing unit
10. Computer applications
11. Registers
12. Assembly programs and compilers
13. Programming systems
14. Fixed and floating points
15. Macro-generators

Business systems design and development (2nd Year, 1st Semester-3 Units)

1. Identification of system objectives
2. Identification of system requirements
3. Methods for achieving system objectives
4. Development of operating procedures
5. Installation of system for each of the following
    a. Customer order and billing
    b. Customer accounts receivable
    c. Inventory control
    d. Sales information
    e. Payroll
    f. Purchasing and accounts payable
    g. General-ledger accounting

Data processing applications and practicum in programming (2nd Year, 2nd Semester-5 Units)

1. Data processing applications
    a. Payroll
    b. Inventory
    c. Accounts receivable and payable
    d. Sales analysis
    e. Policyholders records
    f. Cost accounting
    g. General accounting
    h. Billing
2. Practicum in programming
    a. Systems
        (1) Analysis
        (2) Design
    b. Programming essentials
    c. Report writing and analysis
    d. Gaming
    e. Simulation
        (1) Forms design
        (2) Flow charting
        (3) Writing programs
        (4) Operating computer
        (5) Debugging
        (6) Running live work
    f. Field project

Advanced programming (2nd Year, 2nd Semester-3 Units)

1. Report generators
2. Macro-generators
3. Assembly programs and compilers
4. Emulators
5. Data scheduling systems
6. Monitors and high level languages
7. Fixed and floating points

HIGHLIGHTS OF THE FINDINGS AND THEIR IMPLICATIONS

The findings from this study seem to fall into three categories as follows:

Findings Concerning Jobs and Job Opportunities in Data Processing

1. High school graduates from data processing programs may enter the following data processing jobs: key punch operator, unit record operator, tape librarian, and computer operator.

2. Graduates of two-year post high school institutions may enter the same jobs as those who graduate from high school data processing programs, but in addition, the following jobs are available to them: programmer, systems analyst (with some further experience and training), and supervisor of data processing (with experience and possibly further training).

3. Generally, the jobs in data processing will become more complex rather than proliferate.

4. Computer manufacturers indicated that little change would take place in computers in the next three to ten years except for miniaturization and greater memory unit capacity; thus, many of the jobs now available will continue to be prevalent for several years to come.

5. With the relative decrease in use of punched cards as input, the proportion of key punch and verifier operators will decrease.

6. Advances in the software will be extensive in the next three to ten years; consequently, opportunities will expand for persons trained in the use of the new software as it is developed and accepted.

7. Programmers will not need to be as technically trained as is presently true. Graduates of two-year post high school programs will be adequately trained for programming positions. However, the programmer as he is known today will become important to the business organization if he is prepared to move into a systems analysis position. Businesses will want their programmers to have the necessary background training to move into the position of systems analyst, or expect the programmer to continue his training on the job so that he may move into the higher level position.

8. Unit record equipment is being phased out with the installation of smaller computers. The position of unit record equipment operator will not be as prevalent in the near future as it has been in the past.

9. Opportunities for persons to program software equipment as it is developed will increase greatly.

10. Persons who will be classified as Applications Specialists will be increasingly in demand. These people will advise businesses on how to use automated systems.

11. An administrative level position possibly will emerge, a person known as an Automated Data Management Specialist, who will be responsible for deciding what to do with the data from the computer. His job will be to teach management through application.

12. As the use of time sharing increases, more and more business employees will need to understand automatic data processing. In a time-sharing installation many of the regular clerks will be responsible for originating and putting data into the automated data processing system. They will be required to be a part of the total system but will not necessarily hold a job classified as a data processing position.

Findings Concerning Teachers of Data Processing

13. A greater proportion of the high school data processing teachers hold degrees than post high school data processing teachers, but post high school teachers had had more advanced training in data processing.

14. More high school data processing teachers received at least some of their data processing background by attending manufacturers' schools than did the post high school data processing teachers.

15. More of the post high school data processing teachers had had work experience, data processing work experience, and on-the-job training than had the high school data processing teachers.

16. More high school data processing teachers are getting business experience in the summer than are post high school data processing teachers.

Findings Concerning Data Processing Curriculums

17. The educational institutions are not preparing enough persons to meet the demands of business. More emphasis must be placed on the preparation of more teachers so that more young people may have the opportunity to be trained in data processing.

18. Communication skills, both oral and written, are demanded of data processing personnel. Both the management personnel and the employees in data processing recognize a weakness in this area which is not being remedied by our educational institutions.

19. Data processing personnel need to be oriented to the total systems approach in business. The educational institutions have not been satisfying this need for the persons in data processing positions.

20. Because the field of data processing education is so relatively new, the programs in the high school and post high school institutions are somewhat similar except that more concentration in data processing courses is found at the post high school level. The major objective of the courses at both levels was vocational training.

21. Mathematics is considered a pre-requisite for data processing courses at the post high school level whereas it is not for the high school level programs in data processing. Managers felt that mathematics should be included as part of a data processing program for its logic values rather than as mathematics per se. Several managers suggested courses in logic be included in the curriculum.

22. Relatively few schools operate a cooperative part-time training program in data processing. Only 50 schools out of 176 schools surveyed had such a program.

23. Three-fourths of those high schools with a cooperative program in data processing require up to six weeks of on-the-job training.

24. Half of the cooperative programs in the post high schools (nine out of a total of 18 programs) have no set amount of time required for the on-the-job training phase of the cooperative part-time program.

25. No opportunities are available in data processing for workers with no specialized training. Persons must either have some specialized training before being placed on a data processing job or may transfer from a job within the firm and receive on-the-job training in data processing resulting in specialized training. Some companies may hire persons without specialized training and give that training to the new employee before putting him on the job.

26. Because the need for data processing employees is so much greater than the number of people being trained in our educational institutions, industry currently is willing to hire persons who have a specialized skill regardless of where they have received their training.

27. Computing machines will be more and more internally programmed, with the result that wiring will become less important in business. However, these persons still will be needed in the technical positions with the computer manufacturers. Many of the programs (particularly in post high school programs) devote a considerable amount of time on wiring boards. This is a skill development that needs less emphasis in training for business data processing jobs.

RECOMMENDATIONS FOR FURTHER ACTION

1. The schools are not meeting the needs in training personnel for the many job opportunities in data processing in business. Much more effort needs to be exerted by school boards, school administrators, teachers, and state supervisors to inaugurate curriculums in data processing and to update the programs currently in existence.

2. Teacher training institutions must train more teachers for the field of business data processing. Since frequently the cost of such a teacher training program is too costly for an individual institution, they should be helped financially by state, federal and/or private business funds. Two approaches to increasing the number of teachers are: (a) summer programs for beginning teachers and for updating current data processing teachers, and (b) in-service training

programs during the academic year offered at strategic locations to train data processing employees as potential teachers and to prepare other teachers for teaching in the data processing area.

3. Businesses should make data processing jobs available for teachers during the summer months.

4. Workshops in data processing occupational information should be developed for counselors and school administrators and in data processing curriculums and equipment for school administrators.

5. Further research is needed in making in-depth analyses of course offerings in the field of data processing.

6. Further research is needed in the development of adequate teacher training programs for teachers of data processing.

7. A similar study to this one should be made again in about five to seven years to recommend changes in data processing curriculums as a result of the new devices and techniques and developments in the teaching of data processing; and also, more importantly, as a result of new developments just now being experimented with in education, such as the ES-70 project, the NOBELS project, use of block programming, use of modular scheduling, and expanded use of on line and real time applications in schools.

PART I

CHAPTER I

THE PROBLEM

The extensive introduction of electronic computers for data processing and other applications in business has created a critical need for greater numbers of more highly skilled personnel. The help-wanted sections of metropolitan newspapers provide ample evidence of this need. Attractive inducements are offered for electronic data processing managers, programmers, computer console operators, systems analysts, tabulating equipment operators, supervisors, punched-card machine operators and many others. To meet these personnel requirements, more people need to be trained, and many of the present management and operative personnel need to be retrained.

Implicit in these quantitative aspects of training for data processing employees are the qualitative facets, bringing up such questions as: What kind and how extensive should the training be for these various people? Who should provide this training and how and when should it be done? While considerable effort has been expended on training programs by several agencies, little objective research has been done to determine these needs.

STATEMENT OF THE PROBLEM

The problem was to determine the implications of integrated data processing[1] for the preparation of office workers as it affects the development of office occupations curricula in public secondary and public post high school institutions offering less than baccalaureate degrees.

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[1] Integrated data processing can be described briefly as automation of source data. The writing for an office operation is put into such a form that subsequent operations requiring this writing can be processed automatically. Integrated data processing, therefore, tends to tie office work together, to integrate it, or to form a whole from the various parts. Mechanization is used. The term "integrated mechanical data processing" would be more precise; but the modern and common term is "integrated data processing" and hence will be used here.

Three broad facets of the problem include:

1. The analysis and evaluation of existing integrated data processing training programs in public educational institutions.
    a. Determination of the location of public secondary and post high school non-degree granting institutions offering data processing courses in these institutions.
    b. Detailed analysis of curricular offerings in selected institutions and the scope of the offerings.
    c. Evaluation of course offerings of educational institutions as they relate to needs of business as determined under 2 below, through suggested curriculums.
2. A study of employees in the integrated data processing programs in selected business offices, as well as a study of the needs as expressed by the data processing management personnel of these offices, to determine the common body of knowledge needed for:
    a. Entry into selected office occupations affected by data processing.
    b. Adjustment to office occupations requiring knowledge or ability in automated data processing techniques.
    c. Patterns of advancement in such office occupations.
    d. Retraining
3. Determination of new and projected developments in data processing as forecasted by manufacturers and users of hardware and software and the influence of such developments on future job opportunities.

PURPOSE OF THE STUDY

The purpose of the study is twofold: (1) to provide guidance for schools in evaluating existing programs and in establishing new programs in integrated data processing, and (2) to furnish information for counselors in providing students with occupational information about employment and career opportunities in the business data processing field.

To fulfill these purposes, data have been collected from four main sources:

1. Data processing management personnel
2. Data processing employees
3. Heads of data processing instructional departments in secondary schools, junior and community colleges, and vocational schools, and from data processing teachers in these schools.
4. Data processing equipment manufacturers.

Data were collected about employees, their preparation for the job, their prior work experience, the duties they perform in their data processing jobs, their evaluation of their education, requirements for entry into several data processing jobs, and information about the future technological developments in the field of data processing equipment that might influence the education of data processing employees. The specific kinds of information gathered are these:

1. Data processing instructional programs
    a. Curriculum
        (1) courses, coverage and sequencing of the units
        (2) expected competencies
        (3) criteria for selection of students
        (4) extent of cooperative work programs in data processing
    b. Instructional materials
    c. Equipment used
    d. Students, their grade level, characteristics
    e. Teachers, their education, work experience and training in data processing
    f. Problems in initiating and maintaining a data processing instructional program

2. Information regarding data processing employees
    a. Job titles and description of the duties involved in several jobs
    b. Educational preparation, including pre-employment training and on-the-job training
    c. Employment record, work history
    d. Employees' evaluation of their training and education
    e. Occupational mobility patterns
    f. Personal characteristics
3. The job
    a. Promotional patterns
    b. Criteria for selection of beginning employees
    c. Supervisory practices
    d. Recruitment practices
    e. Pay scales
4. Future developments of data processing equipment

In order to define the problem more specifically, answers were sought to the following questions:

1. Are data processing programs as taught in educational institutions meeting the demands of firms for data processing personnel?
2. What jobs are available for high school graduates from data processing programs?
3. What jobs are available for graduates from programs in two-year post high school institutions?
4. What major differences are there between data processing programs at the high school and post high school levels?
5. What differences are there in the preparation of teachers instructing data processing courses at the high school and post high school levels?

6. What kinds and amount of on-the-job training are required for graduates from data processing programs at the high school and post high school levels?

7. How much on-the-job (and what kind) of training is required for graduates from cooperative part-time training programs in data processing at either level of education?

8. What are the opportunities for employment of workers with no specialized training in data processing?

9. What significant characteristics distinguish strong from weak programs in data processing?

10. What are emerging job opportunities in new activities related to data processing that will develop in the future in light of developments in the technology of data processing?

ORGANIZATION OF REPORT

The organizational pattern of this report follows the plan of giving the reader, in Part I, the problem under investigation and the findings of the study, followed by the curricular implications of data processing resulting from the analysis of the data collected. Part II is devoted to a presentation of descriptions of the seven major job categories in data processing and an analysis of the data collected from the schools offering course work in data processing in regard to the curricular patterns in those schools and the background of the teachers in data processing.

Part I is composed of five chapters: Chapter I, The Problem; Chapter II, Findings; Chapter III, Curricular Implications; Chapter IV, Review of Related Literature; and Chapter V, Procedures.

Part II presents the data gathered from 353 businesses and 174 school systems in the study. This section has seven chapters (VI through XII), each chapter devoted to one of the seven job categories into which the data processing employees are classified: key punch operator, unit record operator, computer operator, tape librarian, programmer, data processing manager, systems analyst.

Part III presents the data and analysis of the data collected from 380 teachers in 176 school systems that are offering data processing. Chapter XIII is a description of the curriculums in the schools surveyed; Chapter XIV presents information regarding qualifications and teaching responsibilities of teachers in the schools surveyed.

Major conclusions from which the curricular implications were derived and recommendations for further action are presented in the Summary at the beginning of this report.

CHAPTER II

FINDINGS

The first modern day computer to work successfully, the Mark I, was designed by Professor Howard Aiken of Harvard and built with the aid of IBM in 1944. In 1946, the ENIAC (Electronic Numerical Integrator and Calculator) was built and completed at the University of Pennsylvania. These were not electronic computers with internal storage of instructions as in today's computers, but the instructions were externally wired in a manner similar to the control panels of electromechanical equipment. The UNIVAC (Universal Accurate Computer), which came as a result of the ENIAC, was designed by Dr. J. Presper Eckert and Dr. John Mauchly who both joined the staff at Sperry Rand.

Computers, however, had been barely introduced into offices by 1954, when a model of the UNIVAC was used by General Electric for the first real application of computers to business data processing work (18:113-114). The computer was first used principally for performing the many repetitious jobs in the office, such as processing payroll and inventory records, and the computers were used for office work only after the mathematical and scientific problems in industry had been completed. As the paper work explosion in business progressed, the need for high-speed operations in the office became prevalent. Later, digital computers were designed especially for data processing in the office.

For the past twenty years, the number of office jobs has been growing at a faster rate than openings for other types of employment. This has been due mainly to the mounting volume of communications, recordkeeping, and other paper work. The use of electronic computers and other new office equipment will not likely keep pace with the increased amount of paper work required by modern business; hence, the need for more and more office workers.

INFLUENCE OF COMPUTERS ON BUSINESS EDUCATION

The computer in the office, the big technological change of the 1950's, made obsolete business education as it had been known and taught. A new dimension, business data processing, was added to the sphere of training for business. The need for training young people for living and working in a computerized world is with us. We have been slow to realize fully the impact of this new technological change--it was not until the late 1950's that any school programs were established to train personnel for positions in data processing. During the years of 1961 to 1964, about 32 school programs per year were established to train data processing personnel, and since 1964 only two or three programs have been started each year. The reason stated most frequently for establishing these programs was the growing demand by industry for trained personnel. About 19 per cent of the high schools and 61 per cent of the junior colleges and vocational schools were offering course work in data processing in 1966, or were planning to offer it (Table 2-1).

Most of the high school data processing programs were found in the New England, Middle Atlantic, and Pacific regions of the United States while the data processing programs in junior colleges and vocational schools were located predominantly in the Pacific, Middle Atlantic, South Atlantic, and East North Central regions of the United States.

Schools have been slow to respond to the need for training young people for positions in data processing. With the ever-growing number of automated data processing installations in business offices, the education and training of workers for these jobs becomes a major concern to those persons responsible for preparing people for those positions. Because the schools have not graduated enough workers prepared for the available positions in data processing, industry has looked elsewhere for these employees; many of whom have come from other jobs and departments within the companies. Those persons today who are now in data processing positions and who have been employed in some other type of work have come principally from sales and services positions or from clerical positions (Table 2-2).

Several of the employees surveyed had had some experience in data processing work prior to coming to their present employer. Many of the data processing jobs held were different from their present job. More of the employees had served as tabulator operator than in any other position (Table 2-3).

Slightly more than four-fifths of the key punch operators have had no previous experience in data processing other than as a key punch operator. A few of them had held the positions of tabulator operator and supervisor. Over half of the unit record equipment operators had held no other data processing job than that before their present job, and over half the computer operators had been unit record equipment operators before their present job.

About 35 per cent of the programmers had held no other data processing position before their present job, and over one-fourth of them had been tabulator operators prior to their present position as programmers.

Table 2-1. Number of Schools Offering or Planning Course Work in Data Processing

Section of Country	High Schools							Jr. Colleges & Voc. Schools						
	Total Schools	Offering D.P. Courses		Anticipating D.P. Courses		Project. Tot. Schools with D.P. Courses		Total Schools	Offering D.P. Courses		Anticipating D.P. Courses		Project.Tot. Schools with D.P. Courses	
		N	%	N	%	N	%		N	%	N	%	N	%
New England	508	102	20	76	15	178	35	40	14	35	4	10	18	45
Mid Atlantic	1451	232	16	255	18	487	34	100	56	56	11	11	67	67
So. Atlantic	644	44	7	58	9	102	16	126	62	49	19	15	81	64
E.So.Central	492	8	2	28	6	36	7	54	18	33	10	19	28	52
W.So.Central	1237	26	2	63	5	89	7	52	25	48	1	2	26	50
W.No.Central	1797	80	4	145	8	225	13	102	29	28	18	18	47	46
E.No.Central	2248	146	6	274	12	420	19	157	78	50	13	8	98	62
Mountain	458	28	6	52	11	80	17	38	13	34	16	42	19	50
Pacific	649	75	12	90	14	165	25	114	79	69	13	11	94	82
Totals	9484	741	8	1041	11	1782	19	783	374	48	105	28	478	61

Table 2-2. Kinds of Jobs Prior to Employment in Data Processing

Previous Job	Present Job						
	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Clerical	240	5	80	72	93	35	24
Office Machines Operator	61	0	18	8	11	9	7
Steno-Typist	134	1	23	14	20	3	1
Accounting	65	6	22	28	53	18	30
Inventory Clerk	18	1	25	22	22	6	7
Trades	34	0	41	40	74	13	13
Factory	30	1	32	37	37	19	6
Supervisory	6	0	16	10	21	12	21
Sales & Service	196	14	102	92	93	46	27
Other	44	1	25	22	45	8	15

Over one-fourth of the systems analysts had held no other data processing position prior to their present job. About one-fourth of them had been unit record equipment operators and about one-fourth of them had been programmers before assuming the position of systems analyst. The rest had held a variety of other data processing jobs.

On the other hand, about 70 per cent of the data processing managers had held other jobs in data processing before becoming manager. About 40 per cent of them had worked as unit record equipment operators before becoming supervisors of data processing.

Table 2-3. Kinds of Jobs Held in Data Processing Prior to Present Job

Previous Job	Present Job					
	Key Punch Oper.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Key Punch Operator	449	34	13	7	14	2
Tabulator Operator	50	90	93	68	62	37
Computer Operator	5	22	50	28	13	5
Programmer	1	2	7	87	15	39
Supervisor D.P.	33	21	12	19	46	24
Systems Analyst	0	0	1	23	8	41
Other	14	6	7	10	10	7
Totals	552	175	183	252	158	155

CHARACTERISTICS OF DATA PROCESSING JOBS

Managers of data processing departments in 353 businesses throughout the United States who were interviewed and over 2,000 data processing employees in those businesses who completed questionnaires provided data and information about the data processing jobs being performed in business. The information sought about the jobs included such things as the duties the employees performed on the job, the amount of overtime required for the job, the amount of supervision required for the different jobs, the promotion patterns for the several jobs, and the salaries received by the employees in the several job categories.

The information concerning the employees in data processing positions collected from management personnel and the employees themselves included such items as ages, education accepted and preferred by management as well as the education of the individuals on the jobs, amount of experience accepted and preferred by management as well as the experience of the persons on the jobs, personal characteristics of individuals performing data processing jobs, and the mobility of data processing employees.

Insight into future technological developments in data processing equipment was obtained by interviews with the advance planning executives of the computer manufacturing companies, who were asked what was being planned in the next three to ten years that would affect the preparation of future data processing employees. The managers of the data processing departments were also asked in their interviews to project their needs and anticipated changes for the next five to ten years.

Data concerning these three aspects of data processing jobs and needs of personnel are presented and analyzed in the following three divisions of this chapter.

Duties Performed in Data Processing Jobs

Table 2-4 shows the duties performed by employees in data processing. The duties are listed in order of frequency of mention, together with the percentage of employees in each of eight different job categories. Because the duties, qualifications and preparation of verifier operators so closely parallel those of the key punch operators, detailed analysis was not made of this particular job in the remaining part of the study. However, the duties are included in this table since the verifier's job is one that can be held by recent high school graduates.

Analysis of Table 2-4 seems to indicate that key punch operators should have knowledge of more than the key punch machine, since over a fourth of them report operating the interpreter, card sorter, and reproducer, and over 10 per cent of them operate an accounting machine as one of their duties.

Card punching was among the 10 most frequently mentioned duties for unit record machine operators (accounting machine operators) and for computer operators and programmers, as well as for the key punch and verifier operators. Programmers and systems analysts both prepare programs to a great extent. Over 95 per cent of the programmers and more than 75 per cent of the systems analysts write programs, and they use several different languages for their programming (Table 5). Autocoder is the language reported the most frequently, with COBOL and machine language reported slightly over half as frequently as was Autocoder.

Table 2-4. Most Commonly Mentioned Duties Performed by Data Processing Employees

Duties	N	%
Key Punch Operator (N = 835)		
Punch cards	807	96.6
Verify punched cards	585	70.0
Operate interpreter	274	32.8
Operate sorter	254	30.4
Operate reproducer	209	25.0
Operate typewriter	115	13.8
Operate collator	105	12.6
Supervise key punch operators	92	11.0
Operate accounting machine	91	10.9
Perform other clerical duties	80	9.6
Verifier Operator (N = 125)		
Verify punched cards	109	87.2
Punch cards	90	72.0
Operate interpreter	35	28.0
Operate sorter	30	24.0
Operate reproducer	29	23.2
Wire reproducer board	15	12.0
Wire interpreter board	11	8.8
Supervise key punch operators	10	8.0
Operate collator	9	7.2
Operate typewriter	8	6.4
Tape Librarian (N = 26)		
File and register tapes	24	92.3
Punch cards	17	65.4
Verify punched cards	12	46.2
Perform clerical duties	11	42.3
Operate sorter	9	34.6
Operate typewriters	8	30.8
Confer re computer time	7	26.9
Operate interpreters	5	19.2
Unit Record Equipment Operator (N = 374)		
Operate the sorter	338	90.4
Operate reproducer	315	84.2
Operate interpreter	289	77.3
Operate collator	237	63.4
Operate accounting machines	259	69.2
Punch cards	257	68.7
Wire collator board	237	63.3
Wire reproducer board	234	62.6

Table 2-4 (Continued)

Duties	N	%
Wire interpreter board	177	47.3
Wire accounting machine boards	150	40.1
Computer Operator (N = 282)		
Operate computer	280	99.3
Operate high speed printer	195	69.1
Operate sorter	185	65.6
Punch cards	158	56.0
Operate interpreter	156	55.3
Operate reproducer	145	51.4
Operate collator	140	49.6
Wire collator board	136	48.2
Wire reproducer board	127	45.0
Test sample routines	111	39.3
Programmers (N = 332)		
Prepare programs	316	95.2
Make flow charts	303	91.3
Debug programs	299	90.1
Code for programming	298	89.8
Make block diagrams	295	88.8
Analyze data flow	263	79.2
Analyze systems	216	65.1
Operate computer	207	62.3
Test sample routines	204	61.4
Punch cards	190	57.2
Data Processing Supervisors (N = 175)		
Confer regarding computer	133	76.0
Schedule computer time	130	74.3
Supervise computer personnel	124	70.8
Supervise auxiliary equipment personnel	100	57.1
Confer regarding key punching	95	54.3
Analyze data flow	78	44.6
Analyze systems	75	42.8
Supervise keypunch operators	75	42.8
Schedule key punching	75	42.8
Operate sorter	74	42.3

Table 2-4 (Continued)

Duties	N	%
Systems Analyst (N = 139)		
Analyze systems	133	95.7
Analyze data flow	121	87.1
Make flow charts	120	86.3
Make block diagrams	108	77.7
Prepare programs	107	77.0
Confer regarding computer	97	69.8
Debug programs	89	64.0
Code for programs	81	58.3
Confer regarding key punching	79	56.8
Test sample routines	73	52.5

Table 2-5. Programming Languages Used on the Job

Language	Job				
	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.	Total
Autocoder	17	195	33	56	301
COBOL	6	104	13	46	169
Machine	5	108	13	41	167
SPS	9	75	19	25	128
FORTRAN	0	13	5	9	27
PL-1	0	10	0	1	11
Algo	1	1	2	1	5
SPA	1	1	0	1	2

Job Satisfactions and Dissatisfactions

As a group, data processing employees are very well satisfied with data processing as a field, say they enjoy it, and plan to stay in it (Table 2-6). Only 12 out of 2,098 employees who responded to this question indicated that they do not enjoy their work and want to change fields.

The smallest proportion of people who indicated enjoyment of the field was among the key punch operators, in which 89.5 per cent said that they liked it and planned to stay; and 3.3 per cent of them indicated that they do not enjoy working in this field. On the other hand, all of the tape librarians and 95 per cent of the programmers said they enjoyed working in data processing and plan to stay in it and none of these two groups of people said they disliked it enough to change fields.

When asked what they particularly liked about their jobs in data processing and what they did not like about their jobs, almost twice as many positive statements were made as negative. A total of 2,520 favorable comments were made in response to this open-end question and 1,376 were negative.

Table 2-6. Data Processing Employees' Degree of Satisfaction with Data Processing as a Field of Employment

Degree of Satisfaction	Key Punch Oper.		Tape Libr.		Unit Recd Oper.		Comp. Oper.		Progr.		Super. D.P.		Sys. Anal.	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Enjoy - plan to stay	730	89.5	26	100	326	89.6	248	93.2	310	94.8	149	93.1	125	89.9
Enjoy - but would like a change	59	7.2	0	0	32	8.8	16	6.0	14	4.3	10	6.2	13	9.4
Do not enjoy - will stay	20	2.4	0	0	4	1.1	1	.4	3	.9	0	0	0	0
Do not enjoy - wish to change	7	.9	0	0	2	.5	1	.4	0	0	1	.6	1	.7
Totals	816		26		364		266		327		160		139	

Job satisfactions. The pattern of what they enjoyed about their jobs differs somewhat according to the level of the job (Table 2-7).

Table 2-7. Sources of Job Satisfaction Expressed by Data Processing Employees

Source of Satisfaction	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Variety	193	8	66	44	37	30	24
Interesting	95	6	47	50	25	15	11
Working conditions	110	5	46	37	24	9	6
Job routine	13	1	1	1	2	0	0
Problem solving	22	3	32	17	131	35	70
Challenge	25	0	29	24	71	34	37
Type of job	227	1	103	57	52	9	4
Co-workers	77	4	39	19	13	33	13
Enough work	38	2	15	13	9	7	5
Experience	51	7	44	41	49	24	9
Everything	40	0	22	7	4	3	2
Totals*	932	37	444	310	417	199	181

*Respondents could each provide more than one reply.

The people working with unit record equipment and key punches and the computer console operators indicated with the greatest frequency that they just liked doing this kind of work and that they like this type of job. On the other hand, the programmers, systems analysts and the data processing department managers enjoyed the problem-solving aspects of their particular jobs. The next most frequently mentioned satisfaction in their jobs was the challenge of the job, which is perhaps closely related to the problem-solving aspect. The second most frequently mentioned satisfaction among the key punch operators and the unit record equipment operators was the variety they found in their jobs. They apparently were working on a variety of machines or with different kinds of documents and found this interesting.

Job dissatisfactions. Among the dissatisfactions with their jobs, the most frequently mentioned was "rush jobs" (Table 2-8).

Table 2-8. Sources of Job Dissatisfaction Expressed by Data Processing Employees

Sources of Job Dissatisfaction	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Paperwork	25	2	27	11	24	7	5
Salary	49	1	24	22	15	1	0
Rush jobs	82	5	38	32	31	24	3
Physical aspects	57	1	18	14	17	2	3
Low probability of promotion	17	1	9	2	6	3	0
Type of job	63	0	59	20	70	6	17
Irregular hours	26	2	18	30	19	18	8
Monotony	75	2	24	14	17	7	2
Information gap	42	0	7	6	8	2	4
Poor equipment	16	0	22	14	14	8	10
Nothing	78	3	27	17	7	16	0
Totals	530	17	273	182	228	94	52

This ranked either first or second by all the people in the various job classifications, with the exception of the systems analysts, for whom it was the third most frequently mentioned dissatisfaction. The particular type of job they were working on was the most frequently stated satisfaction for people operating unit record equipment, but it was also the most frequently mentioned dissatisfaction named by these people. Of the 444 satisfactions listed by operators of unit record equipment, about 23 per cent said that the "type of job" was what they like about their jobs, but of the 273 responses regarding dissatisfactions, the "type of job" was given by 21.6 per cent of this group.

Programmers, too, listed the "type of job" most frequently as a dissatisfaction, with 70 out of 228 responding this way.

The people in lower-level data processing jobs to a certain extent expressed dissatisfaction with salaries, but this was not true for programmers and people in other higher-level data processing jobs. Computer operators and data processing supervisors' second most frequently named dissatisfaction was the irregular hours. Almost as many key punch operators said they disliked nothing about their jobs as complained about rush jobs, which was the number one complaint.

Overtime

Table 2-9 shows the amount of overtime data processing employees work each week as estimated by the data processing managers. More than half of the firms reported that their key punch operators average up to three hours of overtime a week, and the managers estimated that unit record operators and computer operators spent up to seven hours a week in overtime work. About half the firms reported that these three groups of employees work up to seven hours of overtime, but about 40 per cent of the companies said their programmers work that amount of overtime and over 20 per cent of them said their programmers work more than eight hours a week overtime. Of 58 replies to this question concerning the data processing manager, 34 of them were that the amount of overtime was more than eight hours a week or else it was seasonal, depending on the particular jobs being run.

Supervision

The managers of data processing employees were asked to indicate the amount of supervision required for each of the data processing positions. The lower the level of job, the more supervision was required (Table 2-10). According to the managers, key punch operators and unit record operators need to be supervised either continuously or several times a day; whereas the programmers and systems analysts tend to be supervised only as needed or several times a week but not daily.

Table 2-9. Amount of Overtime Required in Data Processing Jobs as Estimated by Data Processing Managers

Amount of Overtime	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
None	73	25	39	21	34	7	11
1-3 hours, weekly	101	10	56	54	44	9	15
4-7 hours, weekly	51	6	51	60	55	8	14
8-11 hours, weekly	9	0	20	33	35	11	6
12 or more hours,weekly	1	1	15	19	24	12	8
Seasonal	54	4	36	27	35	11	9
Totals	289	46	217	214	227	58	63

Table 2-10. Amount of Supervision Required of Data Processing Employees by Rank of Frequency of Mention

Amount of Supervision	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
None						2	
Continuous	2	3	3	3			
Several times daily	1	2	1				
Once a day		2		1	3		
Several times weekly					2		2
Weekly							3
As needed	3	1	2	2	1	1	1

Promotion Patterns

To determine whether certain data processing jobs might be dead-end jobs and to discover possible promotion patterns in the data processing field, the managers of data processing departments were asked to indicate the probability of promotion from each of the positions and to name the jobs into which people in each job category might be promoted (Tables 11 and 12). The responses indicate some variation in probability of promotion from job category to job category in the data processing field. The key punch operator's chance for advancement is relatively low; over 60 per cent of the managers indicated they have a low probability to little or no chance for promotion. With the exception of the data processing manager, all the other positions have a high to average probability of promotion to other positions, except the tape librarian about whom the opinions were quite evenly divided.

Key punch operators tend to be promoted to the position of unit record equipment operators, with about half as many responses indicating they might become computer operators, provided they had sufficient interest and aptitude. Unit record operators, on the other hand, tend to be promoted to the position of computer operator or to programmer, and computer operators are most likely either to programmers or are promoted to some supervisory position. Several avenues, however, are open to programmers, with over 100 responses each indicating a possibility of promotion to any one of four positions; namely, chief programmer, some supervisory position, data processing manager, or systems analyst. The data processing managers interviewed also said that programmers had the greatest probability of promotion of all the data processing employees.

The data processing managers were asked to indicate the probable effect of education on promotion, and for all positions they felt that education influenced promotion probability, at least somewhat (Table 2-13). Over half of the managers thought that education had no effect on promotion for key punch operators and about a fifth of them thought it might make some slight contribution in determining promotability. About half or more of the data processing managers indicated that education has quite a bit or a definite effect on promotion for all other jobs, with over 60 per cent of the managers indicating that education is a factor in promotion for programmers, data processing managers, and especially for systems analysts.

Table 2-11. Probability of Promotions for Data Processing Employees*

Probability	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
High	43	12	76	81	107	7	28
Average	80	16	91	107	101	16	20
Low	115	17	38	37	29	13	10
Very little or none	77	10	18	12	15	14	8

*The number refers to the number of times the job was mentioned by data processing managers.

Table 2-12. Jobs to Which Data Processing Employees May Be Promoted*

To	From						
	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Coding Clerk	18		4				
Tape Librarian	33		16				
Unit Recd Oper.	168		39				
Comp. Oper.	65	28	126				
Programmer	26	20	110	197			
Chief Progr.			11	21	157		
Supervisor	67		38	147	122	31	34
Super., D.P.			27	25	110		36
Sys. Anal.			15	42	146		
Proj. Dir.				14	58		37

*The number refers to the number of times the job was mentioned by data processing managers.

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Table 2-13. Effect of Education on Promotion of Data Processing Employees*

Effect	Key Punch Oper.		Tape Libr.		Unit Recd Oper.		Comp. Oper.		Progr.		Super. D.P.		Sys. Anal.	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Definitely	41	13.4	5	9.1	33	15.1	46	20.0	83	32.4	29	51.8	28	42.4
Quite a bit	30	9.7	11	20.0	47	21.5	65	28.2	73	29.3	6	10.7	15	22.7
Some	67	21.9	23	41.8	80	36.5	78	36.6	60	24.0	9	16.1	12	18.2
None	168	55.0	16	29.1	59	26.9	42	18.2	33	13.3	12	21.4	11	16.7
Totals	306		55		219		231		249		51		66	

*The number refers to the number of times the job was mentioned by data processing managers.

Salaries

The median monthly salaries reported by the data processing employees range from $340 for key punch operators to $817 for systems analysts (Table 2-14). The salaries reported by the data processing employees in this study parallel closely those reported by the EDP Salary Study conducted by Business Automation (1). The median salary for men in each job category was $85 to $90 per month higher than for women in the same job classification (See Appendix A, Table 1).

Table 2-14. Median Monthly Salaries of Data Processing Employees

	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Number of employees	834	26	373	275	331	162	138
Median Salaries	$340	$425	$428	$478	$627	$741	$817

CHARACTERISTICS OF DATA PROCESSING EMPLOYEES

According to the managers who were interviewed, the personal characteristic common to people in all but one of the data processing job categories was the ability to work under pressure, emotional stability (Table 2-15). It ranked first, second or third in frequency of mention for all job categories except data processing manager and systems analyst. But the trait that was ranked first or second in most job categories was the ability to get along with people, perhaps of prime importance because of the amount of pressure under which many of the data processing employees have to work.

The data processing managers said the outstanding characteristic of key punch operators was that they liked routine, liked knowing exactly what a particular job was and how and when to do it. On the other hand, they felt that programmers, data processing managers and systems analysts were creative people who were logical thinkers. Programmers and tape librarians were described as being good detail workers who were very thorough in the work they did.

Table 2-15. Personal Characteristics of Data Processing Employees

Characteristics	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Logical thinker			16	23	77	14	22
Get along with people	20			24	39	14	24
Can work under pressure	24	6	21	29	38		12
Detail worker; thorough		7			37		
Dedicated; willing to work	19			18	34	5	
Creative; accepts challenge					34	7	15
Perfectionist	16	6	14				
Accurate		4					
Methodical		4					
Machine inclined			26	21			
Drive; desire to get ahead						5	
Persistent; patient						5	
Flexible; Adaptable			12				
Likes routine	56						

Age

Data processing is a young man's field of endeavor (Table 2-16). The median age of all levels of data processing positions ranged between 25 years of age for key punch operators to 33 years of age for systems analysts and data processing supervisors. Key punch operators were the youngest group, with half of them 25 years or younger. Although the median age of computer operators is a little higher than for key punch operators, slightly over 70 per cent of them are 30 years or younger; and over 60 per cent of the tape librarians, unit record equipment operators, and programmers were in this age group.

Data processing has been and is a rapidly growing, rapidly changing field of work; possibly young people accept and adjust to change more easily than do older people; consequently, this is an attractive field for youngsters.

Table 2-16. Ages of Data Processing Employees

Age	Per Cent of Employees						
	Key Punch Oper. N=832	Tape Libr. N=26	Unit Recd Oper. N=373	Comp. Oper. N=275	Progr. N=331	Super. D.P. N=162	Sys. Anal. N=138
Less than 21	24.0	26.9	11.8	8.4	2.4	0	0
21-25	26.1	15.4	29.2	37.4	30.2	6.8	13.0
26-30	15.4	19.2	19.6	24.8	30.8	26.5	27.5
31-40	18.8	30.8	20.9	22.9	28.7	45.1	42.8
Over 40	15.7	7.7	18.5	6.5	7.9	21.6	16.7
Median age	25	28	28+	27	29	33	33

Education

The managers of data processing departments in the 353 businesses participating in the study were asked what the minimum and preferred levels of education were for the several job levels in data processing. At least a high school education is the minimum amount of education acceptable for any of the positions (Table 2-17), but the higher the level of the job, the fewer the managers who find a high school education adequate preparation for the job.

Table 2-17. Minimum Amount of Education Acceptable by the Data Processing Managers for Each of the Data Processing Jobs

Education	Percentage of Response						
	Key Punch Oper. N=832	Tape Libr. N=26	Unit Recd Oper. N=373	Comp. Oper. N=275	Progr. N=331	Super. D.P. N=162	Sys. Anal. N=138
High School	84.4*	95.2	88.5	83.2	57.7	49.1	31.9
Junior college-Technical			1.6	6.4	19.5	16.4	24.6
Other post-High School	15.6	4.8	9.5	10.4	14.2	16.4	5.8
Degree			0.4		8.6	18.1	37.7

*The figures represent the percentage of responses by 353 managers.

A high school education was the minimum amount of education acceptable for the positions of key punch operator, tape librarian, unit record operator, and computer operator, although half the managers said they preferred that unit record equipment operators have some work beyond high school (Table 2-18), and over 65 per cent preferred to have computer operators with more than high school education. Post high school or junior college training was considered by 34 per cent of the managers to be the minimum amount of education acceptable for programmers, and about 58 per cent of them said they would accept high school education as a bare minimum for programmers. However, nearly 96 per cent stated that their preference was for programmers to have either a degree (61.4 per cent) or at least some work beyond high school, with nearly 35 per cent of the managers indicating that they preferred that programmers have at least a junior college or vocational school education.

Slightly less than half the managers said that high school was adequate education for the data processing manager, and about 32 per cent considered high school minimum acceptable education for the systems analyst. Slightly more than 93 per cent of the managers said that preferably data processing managers should have more than high school level work, with nearly two-thirds of them stating a preference for a college degree as minimum educational level for these managers; and according to 87 per cent of the managers, the systems analyst should have a college degree.

Table 2-18. Amount of Education Preferred by the Data Processing Managers for Each of the Data Processing Jobs

Education	Percentage of Response						
	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
High School	69.4*	73.0	45.7	33.2	4.1	6.6	2.9
Junior college-Technical	8.2	15.9	23.4	36.4	24.7	15.0	5.8
Other post-High School	21.8	11.1	26.0	22.0	9.8	11.9	4.3
Degree	0.6	0	4.9	8.4	61.4	66.4	87.0

*The figures represent the percentage of responses by 353 managers.

In order to compare management requirements regarding educational level for data processing employees with that actually attained by the employees, the employees were asked to report their highest educational level (Table 2-19). Half the key punch operators had completed high school, and most of the other half had had some post high school training, although frequently this post high school training was only a short key-punch training sequence at a specialized school. The tape librarians had the least post high school education, with 77 per cent of them having only completed high school.

Over half the computer operators and 44 per cent of the unit record equipment operators had gone to school beyond the 12th grade; and 80 per cent of the programmers had more than a high school education. About half the programmers had attended either junior college or some specialized school after graduating from high school, and over 31 per cent of them held college degrees.

Nearly 90 per cent of the systems analysts had some education beyond high school, with over 40 per cent of them holding college degrees. In most of the job categories, the educational level of the data processing employees was above the minimum acceptable to the managers, but not as high as the managers would prefer.

Table 2-19. Educational Level Attained as Reported by Data Processing Employees

Education	Percentage of Response						
	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
No. of people	834	26	374	275	331	162	138
Less than High School	5.0	3.8	6.1	2.5	1.5	2.5	0.0
High School	54.1	76.9	49.7	43.3	18.7	37.0	12.3
Some post-High School	40.0	19.2	40.9	52.0	48.6	44.4	47.1
Degree	0.8	0.0	3.2	2.2	31.1	16.0	40.6

High school general education courses. The employees were asked to check the courses studied in high school that they have found most helpful and next most helpful in performing their jobs. The high school general education course of most value to the data processing employees in all job categories was general mathematics (Table 2-20). Advanced mathematics was considered most valuable by the three upper levels of positions, programmers, systems analysts, and data processing managers. For the lower level positions, key punch operator, unit record operator, and computer operator, English ranked second as most valuable general education course. English and general mathematics were considered to be second most helpful general education courses by all data processing personnel.

Advanced mathematics was named most frequently as the high school general education course in which more work should have been taken by all data processing employees except for key punch operators who wished they had taken more general mathematics (Table 2-21). Next in frequency of mention of courses in which data processing employees would have liked more background were English and social science.

Table 2-20. High School General Education Courses Considered Most Valuable by Data Processing Employees (Ranked by Frequency of Mention)

Courses	Key Punch Oper.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Most Helpful						
General Mathematics	1	1	1	1	1	1
Advanced Mathematics	3	3	2	2	2	2
English	2	2	3	3	3	3
Social Science	4	4	4	5	4	4
Science				4	4	
Industrial Arts	4					
Second Most Helpful						
General Mathematics	2	2	1	2	2	1
Advanced Mathematics	4	4	3	1	3	3
English	1	1	2	2	1	2
Social Science	3	3	4	4	4	4
Science	5			5		
Industrial Arts	6					

Table 2-21. High School General Education Courses in Which Data Processing Employees Wished More Work (Ranked by Frequency of Mention)

Courses	Key Punch Oper.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
General Mathematics	1	2	2	4	3	3
Advanced Mathematics	2	1	1	1	1	1
English	3	3	3	2	2	2
Social Science	4	4	4	3	4	4
Science	6	5	5	5	5	5
Industrial Arts	5	6	6	6	6	6

The managers of data processing departments were asked which of the general education courses they considered helpful for their data processing personnel. Oral and written communication were named first or second most frequently as being the most helpful for almost all data processing employees in performing their jobs (Table 2-22), with algebra being named most frequently as the most helpful course only for programmers and for data processing managers.

Table 2-22. General Education Courses Considered by Management to be Most Helpful for Data Processing Personnel
(Ranked by Frequency of Mention)

Courses	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Oral Communication	1	1	1	1	3	2	1
Written Communication	2	2	2	2	2	2	1
Social Science	6	3	5				
Logic/Philosophy	5	3	4	4	4	4	3
Algebra	3	3	3	3	1	1	2
Analytic Geometry					5	5	
Psychology	4			5		3	4

High school business courses. Although typing was considered the most helpful business course by some of the people in each job category (and especially by key punch operators), more people in the upper-level job listed it as being the least helpful of high school business courses (Table 2-23). Key punch operators tended to find that bookkeeping was not helpful and work in calculating machines was not mentioned very frequently as being either most or least helpful. More people than not considered business mathematics a helpful course in their work, which was true also for bookkeeping, with the exception of the key punch operators. Introduction to business was also a helpful course according to the data processing employees.

Table 2-23. High School Business Courses Named as Most and Least Helpful by Data Processing Employees

Courses	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Most Helpful							
Introduction to Business	27	7	22	14		10	8
Typing	554	10	68	23	19	10	
Shorthand							
Calculating Machines						1	
Business Math			28	28	46	25	25
Office Procedures							
Data Processing						8	
Bookkeeping	30		69	57	39	36	22
Least Helpful							
Introduction to Business	26		13			7	
Typing			65	43	52	27	28
Shorthand	328	6	71	40	27	25	10
Calculating Machines					7	1	
Business Math	22					2	
Office Procedures	26			10		2	
Data Processing							
Bookkeeping	91	3		8		7	7

Post high school general education courses. The post high school general education courses considered to be most helpful in their work paralleled closely those mentioned by the data processing employees in evaluating their high school work (Table 2-24), with general mathematics being most frequently mentioned as most helpful by people in all job categories who had had some post high school education.

Table 2-24. Post High School General Education Courses Considered Valuable by Data Processing Employees
(Ranked by Frequency of Mention)

Courses	Key Punch Oper.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Most Valuable						
General Math	1	1	1	1	1	1
Advanced Math			3	2		4
English	2	2	2	3	2	2
Social Science		3	4		3	4
Psychology	3					
Philosophy/Logic						3
Second Most Valuable						
General Math	2	2	2	1	3	2
Advanced Math			4	1		
English	1	1	1	3	1	1
Social Science		3	3	4	2	3
Psychology	3					

The ranks of the frequency with which English and advanced mathematics were mentioned as most helpful courses switched from the high school to the post high school level. Where advanced mathematics was second most frequently mentioned helpful course at the high school level, English ranks second of the post high school courses. At the post high school level, social science ranks higher in frequency of mention than at the high school level and psychology appears as a valuable course.

Advanced mathematics is considered only by programmers to be the second most valuable course at the post high school level, with English being most frequently mentioned by all other groups. Social science courses rank about the same at this level as they did at the high school level.

The data processing employees expressed their opinions about the area in which they would have liked to have had more work while in school. Again the most frequently mentioned is mathematics, general mathematics by the employees in the lower level jobs and advanced mathematics by those in programming, data processing management, and systems analysis (Table 2-25).

Table 2-25. Post High School General Education Courses in Which Data Processing Employees Wished More Work
(Ranked by Frequency of Mention)

Courses	Key Punch Oper.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
General Math	1	2	2	4	3	3
Advanced Math	2	1	4	1	2	1
English	3	3	3	3	1	2
Social Science		3	1	2	3	
Psychology	3					

Post high school business courses. The post high school business course considered most helpful by the data processing personnel was data processing equipment; this course was listed more than twice as many times as any other business course (Table 2-26).

The other post high school business courses listed as most helpful by the data processing employees in frequency order were: accounting principles, typewriting, business mathematics, intermediate accounting, data processing applications, calculating machines, statistics, and principles of management.

Shorthand was the most frequently mentioned as the least helpful of the post high school courses, although the number of people who listed "least helpful" courses is smaller than those who found courses valuable (Table 2-27). Business English is listed as a "least helpful" course quite frequently among the personnel in lower level jobs, but not by the employees in the higher data processing positions.

The managers of data processing personnel were asked their opinions of the kinds of business courses that would be helpful for their employees in their particular jobs (excluding courses directly in data processing and equipment operation). Introduction to business was one course to appear with relatively high frequency for each of the job categories, although accounting and introduction to systems were the most frequently listed courses for programmers (Table 2-28).

Table 2-26. Most Helpful Post High School Business Courses Mentioned by Data Processing Personnel*

Courses	Key Punch Oper. (N=341)	Tape Libr. (N=5)	Unit Recd Oper. (N=165)	Comp. Oper. (N=149)	Progr. (N=264)	Super. D.P. (N=98)	Sys. Anal. (N=121)
Data Processing Equipment	162	0	161	85	94	39	33
Calculating Machines	33	1	34	16	21	10	5
Typing	150	4	29	16	9	10	4
Shorthand	5	2	1	2	0	0	0
Office Procedures	20	1	9	3	3	3	2
Business English	14	1	14	4	24	19	18
Report Writing	2	0	4	4	20	9	16
Other Business Skills	21	1	11	19	23	8	6
Accounting Principles	34	1	41	50	69	36	43
Intermediate Accounting	15	1	34	12	37	29	24
Cost Accounting	5	1	11	5	24	14	9
Income Tax Accounting	5	0	2	2	1	2	2
Advanced Accounting	4	0	3	4	7	6	7
Other Accounting	1	0	3	2	1	3	4
Management Principles	4	0	12	12	26	22	23
Office Management	3	0	5	0	5	9	5
Personnel Management	4	0	2	7	6	7	11
Decision Theory	1	0	2	1	9	2	6
Operative Research	1	0	0	2	4	4	5
Data Processing Applications	10	0	21	21	40	15	22
Other Management	2	0	0	2	5	1	2
Introduction to Business	18	0	17	16	24	13	6
Business Math	27	0	32	18	45	24	21
Statistics	2	1	8	7	45	19	34
Marketing	0	0	6	3	7	6	13
Finance	3	0	5	11	10	4	18
Other	2	0	0	5	5	3	2

*Totals are greater or smaller than N because employees could check more than one course or not all employees had had particular courses.

Table 2-27. Least Helpful Post High School Business Courses Mentioned by Data Processing Employees*

Courses	Key Punch Oper. (N=341)	Tape Libr. (N=5)	Unit Recd Oper. (N=165)	Comp. Oper. (N=149)	Progr. (N=264)	Super. D.P. (N=98)	Sys. Anal. (N=121)
Data Processing Equipment	3	3	0	0	5	1	1
Calculating Machines	21	2	10	6	20	7	4
Typing	13	2	31	17	30	16	13
Shorthand	94	1	23	10	14	9	9
Office Procedures	23	2	8	8	7	7	2
Business English	50	2	27	19	16	11	10
Report Writing	33	1	9	8	7	4	4
Other Business Skills	14	0	11	7	4	0	2
Accounting Principles	7	0	8	4	14	6	5
Intermediate Accounting	3	1	3	2	13	5	2
Cost Accounting	6	1	7	5	11	5	9
Income Tax Accounting	13	0	12	7	18	15	16
Advanced Accounting	4	0	4	3	9	3	3
Other Accounting	1	0	2	1	12	2	4
Management Principles	2	0	8	8	9	6	7
Office Management	1	0	4	2	8	5	9
Personnel Management	0	0	5	1	10	2	20
Decision Theory	0	0	0	0	1	3	0
Operative Research	0	0	1	1	1	1	1
Data Processing Applications	1	0	0	0	2	2	2
Other Management	0	0	0	1	4	1	4
Introduction to Business	4	2	15	8	21	7	13
Business Math	4	1	4	7	7	3	4
Statistics	3	0	4	7	20	7	16
Marketing	5	0	6	7	26	14	16
Finance	3	0	11	2	24	11	18
Other	1	0	5	2	7	1	4

*Totals are greater than N because employees could check more than one course or not all employees had had particular courses.

Table 2-28. Business Courses Desired by Management for Data Processing Employees

Courses	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Management							
Principles	11	4	34	48	134	69	52
Personnel	13	4	26	32	84	69	35
Office Management	42	13	50	47	105	62	39
Records Management	56	26	81	76	127	65	44
Quality Control	29	14	32	53	105	55	40
Introduction to Systems	37	16	84	126	227	71	60
Finance							
Principles	15	5	34	35	128	48	50
Money and Banking	17	4	20	22	66	22	28
Accounting							
1st Year	58	10	106	105	214	51	48
2nd Year	6	2	43	34	159	63	51
Cost	6	1	28	17	96	44	47
Tax	2	0	8	5	53	25	33
General Business							
Introduction to Business	128	25	95	144	200	53	56
Statistics	18	8	34	66	196	52	58
Quantitative Analysis	0	1	4	15	119	33	42
Business Law	4	2	4	35	55	26	26
Economics	21	5	21	2	111	41	42

Introduction to systems was the first or second most frequently mentioned course for all but the key punch operators. Although systems may not be directly of use to these people, most managers indicated they were interested in people in all these positions as promotable material and that such backgrounds would help them advance in the data processing field.

The quantitative courses appear to be considered valuable for the programmer and the systems analyst to a greater extent than for any other of the jobs. Although in some schools cost accounting is a prerequisite to programming courses, it is among the courses least frequently mentioned by managers as desirable background for programmers.

Three courses stand out as the ones that computer operators should have, according to the managers interviewed; namely, introduction to business, introduction to systems, and the first year accounting course. Data processing managers and systems analysts, along with the programmers apparently need rather broad business backgrounds according to the managers who were interviewed.

Employees' evaluation of their education. The data processing employees were asked how well they thought their education had prepared them for their jobs. They checked whether they felt very well prepared, adequately or inadequately prepared. About one-third of them felt inadequately prepared with the education they had received in school (Table 2-29), and this feeling was even more pronounced among the employees who had not studied data processing in school than it was for those whose education included some training in data processing. The percentage of employees who felt inadequately prepared for their jobs ranged from about a third of the key punch operators up to 41 per cent of the computer operators. The proportions of people in the other job categories who felt their education was inadequate were between these two extremes.

Key punch operators seemed most satisfied with their educational training, both those with and those without data processing background. Among the employees in the other data processing jobs, more of the computer operators and systems analysts than other personnel felt that their educational experience was either adequate or had prepared them very well for working in the data processing field, although the computer operators without data processing training were the most dissatisfied with the preparation they received in school. With the exception of key punch operators, a greater proportion of the programmers and the systems analysts who had studied data processing in school said they were very well prepared for their jobs on the basis of the education they had received (Appendix A, Table 2).

Table 2-29. Evaluation of Education by Data Processing Employees

Position	Very Well	Adequate	Inadequate	Totals
Key Punch Operator (Total)	125	439	183	747
Had No D.P. Training	19	200	112	331
Had D.P. Training	106	239	71	416
Tape Librarian (Total)	1	15	8	24
Had No D.P. Training	1	10	6	17
Had D.P. Training	0	5	2	7
Unit Record Operator (Total)	34	189	117	340
Had No D.P. Training	9	94	67	170
Had D.P. Training	25	95	50	170
Computer Operator (Total)	25	153	75	253
Had No D.P. Training	9	62	50	121
Had D.P. Training	16	91	25	132
Programmer (Total)	42	182	95	319
Had No D.P. Training	12	87	56	155
Had D.P. Training	30	95	39	164
D.P. Supervisor (Total)	14	83	52	149
Had No D.P. Training	8	52	34	94
Had D.P. Training	6	31	18	55
Systems Analyst (Total)	22	74	39	135
Had No D.P. Training	12	41	29	82
Had D.P. Training	10	33	10	53

On-the-Job Training Courses

In spite of the fact that the employees said that their education prior to employment in data processing was adequate or that it prepared them very well for their jobs, the business firms in which these people work offer a variety of courses for their employees at all levels of data processing (Table 2-30). Over 75 per cent (271 out of 353 companies) provided further key punch training on the job for their key punch operators. Presumably, this is to teach them not so much the operation of the key punch machine but rather to familiarize them with the format of the data to be punched and the source documents on which these data appear.

Unit record equipment operators get further on-the-job training in board wiring and equipment operation, key punching and introduction to data processing. The on-the-job training in computer operation is perhaps to acquaint the operators with the particular makes and models of computers used by the companies. Several other courses quite widely offered on the job to these people appear to be the kind that not only help employees do a better job by providing more understanding of data processing as a whole, but they are the kinds of things management considers to be of particular use in higher level jobs. They seem to be helping their employees prepare for promotion with such courses as introduction to data processing, theory and logic of computers, flow charting, and data processing applications. These same courses are areas of on-the-job instruction for programmers in a good many companies also. Perhaps data processing managers and systems analysts, who tend to have more education than the other employees, are more adequately prepared, since relatively few companies provide on-the-job training courses for these people (Appendix A, Table 3).

Experience

According to the data processing employees, they obtained their jobs through three main sources: they were told about openings by their friends, they obtained their jobs through services of private employment agencies, or they had made direct inquiry to the company (Table 2-31). More computer operators and key punch operators had answered advertisements to obtain their jobs than had any other group, and more programmers had received their jobs through school placement services than had any other category of employees.

However, when the employers were asked through what source they had obtained their data processing employees, their answers were different from the information given by the employees. Although most employees said they had obtained jobs through their friends, this was

Table 2-30. On-the-Job Training Courses Offered to Data Processing Employees.

Courses	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Typing	44	7	10	11	6	3	4
Key Punch	271	16	110	80	81	14	17
Calculating Machine	46	6	61	45	48	12	19
Unit Record Operations	65	14	195	132	111	18	28
Wiring Boards	36	6	179	82	56	17	12
Operating Paper Tape	19	3	29	47	47	11	15
Computer Operations	21	15	64	220	175	33	36
Introduction to Data Processing	65	26	107	162	178	33	48
Theory Computations	23	12	61	135	187	30	44
Programming	11	8	47	121	232	41	53
Flow Charting	15	11	87	111	207	30	46
Data Processing Applications	41	13	91	118	189	34	47

Table 2-31. Percentage of Data Processing Employees Who Obtained Their Jobs Through Various Means

	Key Punch Oper. (N=834)	Tape Libr. (N=26)	Unit Recd Oper. (N=373)	Comp. Oper. (N=274)	Progr. (N=331)	Super. D.P. (N=162)	Sys. Anal. (N=139)
School	9.8	0.0	9.4	9.1	12.4	4.9	7.9
Referred by friend	28.5	26.9	27.1	28.8	24.5	25.3	33.3
Answered ad	13.3	7.7	11.3	13.5	10.6	12.3	9.4
U.S.E.S.	7.3	7.7	4.6	5.1	3.9	2.5	2.2
Private agency	14.6	11.5	15.8	13.9	18.1	14.8	16.5
Direct inquiry	21.0	38.5	23.1	24.8	22.7	22.8	18.7
Referred by equipment manufacturer	1.2	3.8	2.4	1.1	3.6	11.1	7.2
School work program	0.8	0.0	1.1	1.4	0.6	0.6	0.7
Other	3.4	0.0	5.1	2.2	3.6	5.6	4.3

not even mentioned by the employers as a source of employees. Perhaps what employees considered referral by friends was considered by the employers to be direct inquiry to the company about possible openings.

The managers said that for the lower level jobs (key punch operator, tape librarian, and unit record equipment operator) most of their employees were hired through placement agencies; and for the higher level jobs (programmer, systems analysts, and supervisors of computer operations) most of their employees were hired from persons answering advertisements (Table 2-32).

Table 2-32. Sources of Data Processing Employees--by Rank as Mentioned by Data Processing Managers

	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Schools	2	2	3	2			
Ads	3	4	2	1	1	1	1
Manufacturer					3	3	
Inquiry		3		3		4	3
Friends					3		
Agencies	1	1	1	3	2	2	2
Promotion	4		4				4

The data processing managers were asked to indicate the minimum amount of experience in data processing they would expect prospective employees to have prior to employment with their firms, and their replies varied with the level of job (Table 2-33). For employees in the two lowest job categories (key punch operator and tape librarian) a great majority of the employers would accept people with no experience in data processing, but over a third of them said that for the other job categories, the employees should have had at least six months or more of experience in data processing; and 35 per cent indicated that a systems analyst should have two or more years of previous employment in data processing.

If the companies could designate a preferred amount of experience in data processing before hiring personnel, they would prefer more than six months of experience for the job levels of key punch operator, tape librarian, unit record equipment operator, and computer operators (Table 2-34). Over half of the managers would like to have their programmers have one to three years experience before they hire them.

Table 2-33. Minimum Data Processing Experience Acceptable by Data Processing Managers
(% of Managers Stating Preferences Indicated)

Months	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Sys. Anal.
0- 6	82.2	86.0	65.1	65.4	52.2	27.1
7-12	14.9	7.8	16.7	23.2	29.5	17.1
13-24	2.6	4.7	4.9	9.3	15.1	19.9
25-36		1.6	2.0	1.2	1.8	18.6
More than 36	0.3		1.2	0.8	1.5	17.1

Table 2-34. Amount of Data Processing Experience Preferred by Data Processing Managers
(% of Managers Stating Preferences Indicated)

Months	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
0- 5	37.9	42.2	29.4	20.8	13.7	11.4	14.3
7-12	34.4	32.8	33.1	35.8	20.7	9.6	10.0
13-24	19.2	20.4	26.9	30.0	36.2	14.4	20.0
25-36	6.1	4.7	4.9	8.1	17.7	14.4	17.1
More than 36	2.3		5.7	5.3	11.8	50.2	38.6

Thirty-nine per cent of the companies prefer three years or more experience for their systems analysts, and 50 per cent prefer three years or more experience for the data processing managers.

Over 50 per cent of all the data processing personnel have had more than three years experience in data processing (Table 2-35). Two-thirds of the systems analysts have had more than five years experience in data processing, and 78 per cent of the data processing supervisors had worked in data processing for over five years (45 per cent of them with 10 years or more experience).

Table 2-35. Total Amount of Experience in Data Processing of Data Processing Employees.
(% of Employees Stating Experience)

Years	Key Punch Oper. (N=832)	Tape Libr. (N=26)	Unit Recd Oper. (N=373)	Comp. Oper. (N=275)	Progr. (N=332)	Super. D.P. (N=162)	Sys. Anal. (N=138
Under 1 Year	22.8	30.8	23.1	15.2	18.4	1.8	2.9
1- 3	20.6	11.5	20.1	21.1	20.4	8.0	15.2
3- 5	16.7	19.2	11.8	19.3	19.9	11.7	15.2
5-10	21.8	23.1	22.5	26.2	30.4	33.3	38.4
10 or More	18.1	15.4	22.5	18.2	10.8	45.1	28.2

Over two-thirds of the data processing employees have worked for their companies over one year (Table 2-36). Fifty per cent of the programmers have been with their companies from one to five years. Forty-seven per cent of the systems analysts have worked for their firms five years or more, and 78 per cent of the data processing supervisors have worked for their companies five or more years (36 per cent more than ten years).

Mobility

Data processing personnel are frequently thought of as a rather mobile group of people. However, the fact that large percentages of them have been with their companies for relatively long periods of time would tend to discount this assumption (Table 2-36). Considerably over

Table 2-36. Length of Time Data Processing Employees Have Worked for Their Companies.
(% of Employees Stating Time)

Years	Key Punch Oper. (N=833)	Tape Libr. (N=26)	Unit Recd Oper. (N=373)	Comp. Oper. (N=275)	Progr. (N=331)	Super. D.P. (N=162)	Sys. Anal. (N=138)
Less than 1 Year	33.6	30.8	26.3	29.4	26.8	6.8	21.7
1- 3	25.7	7.7	22.0	20.4	28.3	18.5	20.3
3- 5	13.6	7.7	12.1	14.5	13.3	16.0	10.9
5-10	15.0	30.8	20.1	20.4	17.5	22.8	20.3
10 or More	12.1	23.1	19.6	15.3	14.1	35.8	26.8

half the data processing employees have been with their companies for more than three years. The youngest group of employees, the key punch operators (40.6 per cent), have worked in their present firms less than three years. Although tape librarians were not much older than key punch operators, over 60 per cent of them have worked in their present firms for more than three years.

Of the managers of data processing departments, about 75 per cent have been with the companies at least three years, with 59 per cent of them having been there five years or longer. With the exception of the tape librarians, the group with the longest time spent with their companies is the systems analysts and the unit record operators.

Data processing people tend also to be from the area of the country in which their company is located, with a median of about 15 per cent of them coming from geographic regions other than the one in which they are now living (Table 2-37). A smaller percentage of women than men has moved into each of the geographic regions, except into the West South Central states. There almost 27 per cent of the women, but 17 per cent of the men, have come from other areas of the United States.

Table 2-37. Geographic Area of the Country from Which Data Processing Employees Moved to Their Present Positions
(% of Employees Indicating Geographic Moves)

Geographical Area	Men	Women	Total
East Atlantic	19.0	12.5	17.2
Mid Atlantic	9.5	4.8	8.0
South Atlantic	12.2	6.1	9.2
East South Central	0	9.1	7.9
West South Central	16.7	26.8	21.9
West North Central	17.2	12.1	14.7
East North Central	11.9	7.6	9.9
Mountain	26.7	24.1	24.8
Pacific	24.8	15.1	20.0
Total	15.9	14.1	15.0

A greater proportion of the data processing people moved into the Pacific, Mountain, and West South Central states than into other regions of the country, with the least amount of immigration into the Middle Atlantic and East North Central sections of the country.

Leisure-Time Interests

The leisure-time activities reported by the data processing employees tended to be those requiring use of the hands or were of an athletic nature (Table 2-38). The activity most frequently mentioned by the people in most job categories was participating in sports, with the most frequently named sport being bowling or golf. Between 17 and 25 per cent of the employees listed sports-participation as a leisure-time activity.

Table 2-38. Leisure Time Activities Reported by Data Processing Employees

Activities	Key Punch Oper.		Tape Libr.		Unit Recd. Oper.		Comp. Oper.		Progr.		Super. D.P.		Sys. Anal.	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Arts and Crafts	281	21.0	4	10.3	63	10.6	35	7.6	48	8.3	20	7.2	20	8.1
Household	97	7.2	3	7.7	66	11.1	61	13.3	67	11.6	29	10.4	23	9.3
Hunting/Fishing	19	1.4	1	2.6	50	8.4	50	10.9	67	11.6	39	14.0	23	9.3
Hiking/Camping	185	13.8	2	6.1	50	8.4	42	9.1	48	8.3	23	8.3	27	10.9
Reading	214	16.0	7	17.9	88	14.9	50	10.9	83	14.4	33	11.9	34	13.7
T.V./Movies	45	3.4	2	5.1	15	2.5	10	2.2	8	1.4	4	1.4	4	1.6
Dancing/Parties	96	7.2	1	2.6	31	5.2	18	3.9	19	3.3	9	3.2	9	3.6
Travel	14	1.0	3	7.7	9	1.5	8	1.7	6	1.0	5	1.8	3	1.2
Music	64	4.8	2	5.1	39	6.6	23	5.0	32	5.6	12	4.3	10	4.0
Sports, Participative	239	17.8	10	25.6	101	17.1	94	20.4	115	20.0	57	20.5	44	17.7
Sports, Spectator	28	2.1	1	2.6	45	7.6	40	8.7	32	5.6	30	10.8	15	6.0
Other	59	4.4	3	7.7	35	5.9	29	6.3	13	2.3	17	6.1	36	14.5
Totals	1341		39		592		460		575		278		248	

Outdoor activities, such as hunting and fishing or camping and hiking, were frequently listed as leisure-time activities also. The key punch operators, however, tended to engage more in arts and crafts activities, more so than another group of employees; but people in other job categories quite frequently mentioned those activities which might be classified as household activities, including such things as interior decorating, furniture refinishing, or upholstering. A greater percentage of men than women listed the household category as their leisure-time interest (Appendix A, Table 4).

Key punch operators and unit record equipment operators listed reading as a leisure-time activity with about the same frequency as did systems analysts and programmers.

The employees were also asked whether or not they enjoyed working puzzles, and by far the majority of them said that puzzles were either "O.K." or they enjoyed them (Table 2-39). People in the higher level data processing jobs more often said they enjoyed the puzzles than did the key punch operators, unit record equipment operators, or computer operators. Over one-sixth of the key punch operators who answered this question said they hated puzzles, compared with about 1 per cent among all the other employee groups.

Table 2-39. Attitudes Toward Puzzle-Solving Activities

Attitude	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.
Enjoy	63	12	191	156	236	106	100
O.K.	59	13	174	114	89	52	36
Hate	24	1	5	4	5	4	1
Total	146	26	370	274	330	162	137

PROJECTED DEVELOPMENTS IN DATA PROCESSING

In order to get some insight into the future of the data processing field and its effect on education of future employees, interviews were held with the vice presidents in charge of advance planning in several computer manufacturing companies; and the managers of the data processing departments of the businesses included in the study were asked about the changes they foresaw in data processing as a field and as it might affect their company.

Opinions of Advance Planning Executives

Interviews were held with the vice presidents in charge of advance planning for the following computer manufacturers:

1. Burroughs Corporation
2. Clary Company
3. Control Data Corporation
4. Digital Equipment Corporation
5. Friden, Incorporated
6. Honeywell
7. International Business Machines Corporation
8. Monroe International, Incorporated
9. The National Cash Register Company
10. Philco Corporation
11. Radio Corporation of America
12. SCM Corporation
13. UNIVAC, Sperry Rand Corporation

In addition, an interview was held with a representative of the Diebold Group, Incorporated because of the extensive research and writing this group has done in the field of data processing.

The interviews were designed to discover plans for technological changes in hardware and software likely to come about in the next three to ten years that might have an effect on the education offered to future data processing employees (See Appendix B-6 for a copy of the interview guide).

The executives generally agreed regarding developments in data processing during the next three to ten years. Following is a summary of those areas of agreement:

1. Miniaturization of computers has and will reduce the cost of computers, so a greater number of even relatively small businesses will be able to afford electronic data processing in some form more than in the past.

2. Computers will have more memory capacity than in the past at less cost per bit. This will enlarge the applications that can be made on the computer, thereby permitting more effective usage of the computer.

3. Enlarged memory units will result in reduction in the need for exactness in programming (the programmer need not be as sophisticated), thus reducing the amount of training required of a programmer. Consequently, the programmer may be trained at the post high school level in the future rather than requiring him to have a college degree.

4. Advancements in the next few years will take place more in the software rather than in the computer. The computer is not used to maximum efficiency today because of the slowness of input devices. Many new advances will take place in the input and output devices of the computer.

5. The use of the punch card as an input device will diminish. This will result in a reduction in the proportion of persons needed to operate key punch machines with the actual number of operators remaining at about the same as the present number of operators. Other devices will be developed and used as input devices that will be more speedy and acceptable for the mass of data to be processed. (All computer manufacturers were of this belief, except one. Since the interviews, the exception has published a study, the results of which agree with the statement that the punched card may not continue as the major input device.)

6. Programmers need to have a logical mind, not mathematical training per se. Generally, the thought has been that the programmer should be highly mathematically oriented; however, algebra seems to be the extent of mathematics background required for business data processing.

7. A trend seems to be developing toward the necessity for the programmer to be an analyst in addition to his being able to program. This would indicate that the programmer will need to continue his training beyond a post high school program to hold and advance in his job as a programmer. A good programmer will likely become a systems analyst in six months to a year.

8. Hands-on training is probably more important psychologically to the prospective computer operator rather than for its actual learning value.

9. Data processing instruction should not be based on just one particular machine. Operators must be able to move from one make of machine to the other.

10. As optical scanning becomes more prevalent, the need for persons for the job of coding will diminish.

11. Time sharing (through service bureaus and computer service utilities) will increase. For the smaller companies, the input/output devices will be in their offices, giving access to a large processor at some other location. Operation of the input/output devices will be performed by regular employees of the small firm.

12. Low-cost remote terminals will be available soon.

13. Video data terminals are probably the greatest development thus far. These are presently technically operable, and will be reduced in cost during the next three to ten years, making them practical for business usage.

14. Machine languages will give way to the higher level languages, such as COBOL.

15. Data processing personnel need to know and understand systems as they relate to the interrelation of all the functions of business.

16. Understanding data processing applications is of more importance than understanding of the computer itself.

17. Unit record equipment is being replaced with computer installations. Unit record equipment will be gradually phased out.

18. The educational system needs to take over the training for data processing. It is not necessary to train on specific hardware; students should be trained with equipment independence.

19. Information will be more commonly fed into the computer using a language form rather than machine language.

20. Data processing employees must be communications oriented.

21. Computer design will change with increased emphasis on making them failsafe. One function may be taken over by another device in the system while the other is being fixed.

22. The wiring concept is decreasing. Programming will be internal with the machine.

Opinions of Managers of Data Processing Departments

The responses of the data processing managers to the question, "What changes in data processing do you see in the next three to five years?" were quite similar to those of the computer manufacturers. The following statements summarize the thinking of data processing managers regarding the future of data processing:

1. Improvement of input/output media and devices is necessary. The computer is too fast for the input/output equipment now used, and these media and devices must be improved in the very near future.

2. Teleprocessing and other data communications media and devices will be used much more widely in the future.

3. The cost of data processing equipment will decrease, making it possible for more and more companies to use electronic data processing in their business.

4. Because of increasing application of real-time and time-sharing equipment, faster core speed for computer and faster input/output media and devices will be developed.

5. The growth in time-sharing and service bureaus, even by companies with data processing installations, will be phenomenal.

6. The use of random access and mass memory for real-time processing will become very prominent in the near future.

7. Because of the newer techniques and newer equipment being installed in the businesses, the upgrading of present employees in business will be a definite trend.

8. Programming languages will be simplified.

9. Unit record equipment is being de-emphasized more and more in business and will continue to be so in the next few years.

10. More sophisticated use will be made of the computer. Instead of using the computer simply to process accounting work, the machine will be used to aid management's decision-making activities.

11. One trend about which nearly total agreement was evident was that the extreme shortage of skilled data processing personnel would continue, especially for programmers and systems analysts.

12. Software packages prepared by the manufacturer will be continually improved.

When asked what changes in their data processing they were contemplating in the next three to five years, the data processing managers suggested these:

1. The IBM 360 (models 30 and larger) will be used very extensively by a majority of the companies.

2. More and more applications will be placed on the data processing equipment.

3. Additional personnel will be added.

4. More "sophisticated" use will be made of the equipment.

5. Nearly all data processing managers indicated plans for use of either time-sharing or of random access and real-time concepts.

6. Wider use of data communications were being made and would continue to be made.

7. Re-education and upgrading of employees will take place, with particular emphasis on systems personnel.

8. A definite move toward centralization of a company's data processing is being planned for those companies spread geographically over a wide area.

9. The change to Report Program Generator or PL-1 programming is being planned.

10. Managers indicated the need to change or revamp their entire systems to be more compatible with the newer third generation equipment.

RECOMMENDATIONS TO SCHOOLS BY EMPLOYEES

The data processing employees were asked to make three recommendations for schools in preparing young people for doing a job like the ones they were performing. Fifteen specific recommendations occurred enough times to be categorized (Table 2-40).

When the recommendations were analyzed according to the employees without and with data processing training, the same six recommendations occurred most frequently. They were to offer instruction in mathematics and accounting, unit record equipment, data processing concepts, a rounded business education, data processing applications, and logic. Those employees without training in data processing added the need for both oral and written communication (English), and those employees with training in data processing added the need for psychology (getting along with people).

If the totals of recommendations are considered, the same six recommendations were the most frequently mentioned. In addition, the recommendations are made that data processing training should begin in the high school and that preparation on the key punch machine should be included in the school curriculum.

PROGRAMMING INSTRUCTION IN THE SECONDARY SCHOOLS

The managers of data processing departments were asked what their experience, if any, had been with prospective employees who have studied computer programming in high school. They were also asked if they had any opinions as to whether programming should be offered in high school. Their replies were tallied as follows:

No response	13
No experience and no opinion	37
Have had employees who studied programming in high school and would recommend offering course in high school	5
Have had employees who studied programming in high school and would not recommend offering course in high school	3

Table 2-40. Recommendations to Schools by Data Processing Employees (Possible Three Answers Per Employee)

Recommendations	Key Punch Oper.	Tape Libr.	Unit Recd Oper.	Comp. Oper.	Progr.	Super. D.P.	Sys. Anal.	Total
Rounded business education	87	3	33	30	59	34	24	270
Prepare on key punch	142	1	20	4	6	1	1	175
Unit record equipment	62	4	45	30	29	15	12	197
Data processing concepts	78	8	47	46	53	39	24	295
Mathematics and/or accounting	83	5	67	69	109	49	42	424
Logic	0	0	0	0	106	26	48	180
Typing	105	2	27	22	0	0	0	156
Hands-on-training	65	1	38	33	20	4	10	171
On-the-job training	55	0	29	21	19	11	7	142
Computer theory	3	0	7	9	21	4	11	55
Data processing applications	71	3	30	49	57	30	23	263
Psychology	23	1	14	10	7	17	11	83
English	33	3	15	12	46	26	23	158
Work hard	70	1	33	16	13	13	13	159
Science	0	0	2	1	8	2	2	15
Starting high school	98	0	24	23	23	18	11	197
Other	83	2	53	28	31	14	9	220

Have had no experience in hiring employees who studied programming in high school. Opinion was that programming should not be offered in high school	145
Have had no experience in hiring employees who studied programming in high school. Opinion was that programming should be offered in high school (but only to develop basic concepts)	124
Have had no experience in hiring employees who studied programming in high school. Opinion was that they should hire such students as programmer trainees	26
Total	353

Several of the managers expressed quite definite opinions regarding this matter. Several of their comments are given here because they are typical of the responses made to this question. Typical of the comments reflecting the opinion that programming should NOT be offered in the high school are these:

> Because each company's computer applications vary so greatly, programming could more profitably be delayed until college.
>
> Programming should be only for specialists--none should be taught in high school.
>
> Programming is a more specialized type of learning that should be taught to graduates of high school who would be more receptive to this type of training.
>
> High school students are not able to see programming in its correct relationship to the over-all system; hence, they would probably not gain much of any value from a course in high school.
>
> Students are not mature and responsible enough for programming, since programmers must work on their own a great deal of the time.

> High school students are not ready for this type of training and there are too many languages. It is more important to get basic concepts.
>
> It is questionable if a person that age has the necessary common sense for learning and applying programming.
>
> We can teach the programming.
>
> I cannot see the value in teaching programming in high school because adequate general background and maturity is lacking at that level.
>
> High school should give them a strong business and accounting background and an introduction to data processing, but programming should wait for a more matured individual.
>
> I would rather train my own programmers. The background is more important.
>
> People cannot "grasp" programming until after high school.
>
> A programmer should have more education, and therefore he should not have programming until later in college, or he will forget what he learned.
>
> Programming changes so fast that by the time they got out of high school, it wouldn't apply.
>
> What is given to high school people is so glorified they want $150 a week. Programming is hard work; it should be offered in college or trade school only.
>
> A good programmer needs a good general and wide background; hence, the high school student does not have this requirement. So programming should be left until after high school.
>
> If we give the high school students a good basic foundation, they won't have any trouble in picking up the programming in a post-secondary school.

Several of the comments indicated that even though they felt that programming should be offered in the high school, they would not employ a newly graduated high school student for a programming job. Typical comments follow:

> It should be taught in high school--the earlier, the better.
>
> It should be taught in high school as an introductory-type class, not at a skill level.

They should have the course to see if they like it.

Programming should definitely be in the high school. Should teach one basic language and spend the rest of the time studying logic.

Should be taught in high school for exposure--then the students would better be able to decide whether or not to enter the field of data processing.

Good idea to introduce programming in high school but maybe not practical because of changes being so rapid.

With the modern teaching methods, high school students definitely could learn programming.

Only teach elementary programming.

Keep the courses on an applications and concepts level--the rest will come from experience.

Kids at this age are mature enough and smart enough to grasp programming concepts.

Offer enough programming to let the students know if they want to go on.

Basic theory of programming should be taught in high school--but nothing specialized.

Courses should be used for finding out whether the students have an aptitude and interest in data processing.

Should take a basic course in high school, but not complete one, so they could go out and get a job. This would take too much time from more important areas of learning that they should pick up at the high school level.

Fundamentals of programming could be taught and used as a stepping stone for data processing in college.

Programming could be taught in high school. In its pure sense it could do no one any harm, since it is merely using ability to think logically.

This is the type of thing that would really interest students of this age.

It would be quite helpful for the student to be exposed to writing some programs. Then students would need additional training when they come to the company to work.

AUTOMATED DATA PROCESSING AND THE TYPIST'S JOB

Data processing managers were asked if automated data processing has changed the nature of the typist's job. Of the 353 managers interviewed, 125 said that it had not, but several of them qualified their "No" with the statement that for some time past their reports had been prepared on machines, so even before they installed their computer systems the reports had not been typed by the typists.

The other data processing managers felt that it had changed the typist's job mostly by upgrading it, making it a more sophisticated job, requiring more knowledge of business and systems than ever before and requiring more judgment on the part of the typist. Of the managers who said the typist's job had changed, 55 said that these people type fewer statistical reports and 42 said that they type fewer reports and do less repetitious work. Only five of the managers felt that typists now are required to type more numbers than previously, and six reported that typists have to type computer input. Only two companies reported they had more typing done now than previously.

The feeling was expressed that the typist's job has become more complex, requires more judgment and more background in business and in data processing terminology, with more clerical responsibility attached such as checking details, looking up and compiling information and abstracting reports from computer printout. Typical of the comments about the typist's job and changes in it are these:

> It has changed in regard to terminology, vocabulary, format; block diagramming is required. Follow-up letters, statements, payroll, royalty checks, and cost reports are done on computers. Typists don't do nearly the number of routine jobs they were doing years ago. Instead they are doing the more complicated jobs that can't be done on the computer.
>
> It has changed the kind of reports that go to management. Now the typist does work on the refinement of the programs. For example, some reports are in too much detail or they don't need the information found on a particular report; so the typist fits it to the particular individual before typing up the report.
>
> The typist of today and tomorrow may tend to do more analyzing and production work, rather than straight copy work.
>
> The typist will do an analysis of the data rather than just compiling it and typing it.

Computers and data processing equipment have added a complexity to the typist's job that was not present before. They must do more detail work and more thinking about the work they are doing.

They help dig out information and facts and check them; hence becoming more of a clerical assistant.

Data processing has now taken over certain tasks formerly done by the typist. This includes making out stockholders' records, typing envelopes, typing of checks to employees, and typing labels. I expect further routine tasks to be taken over by the computer such as the typing of form letters, etc. The typist's job has become somewhat more sophisticated with added responsibility and a partial elimination of numerous routine tasks.

At one time our company had 150 typists answering the 7,000 letters a day that our company receives. Since the installation of the computer, this number of people has been cut to approximately 15. These people were absorbed or the slack taken up by normal attrition. The kind of typing job that now remains is more concerned with a more complex, more complicated kind of typing job. They answer the "problem" letters that include two-page letters, special inserts, more details that have to be checked out, and a higher level of analyzation. The computer does 93 per cent of the routine answering of letters, while the remaining 7 per cent are handled by the 15 typists.

CHAPTER III

RECOMMENDED CURRICULUMS

Curricular offerings in data processing at the secondary and post secondary levels became prevalent shortly after 1960. School administrators and business educators have been concerned with the rapid development of mechanized and automatic data processing equipment and its effect on business offices and on the vocational business education curriculum.

The extensive introduction of electronic computers for data processing and other applications has created a critical need for greater numbers of more highly skilled personnel. The rapid growth in this area has necessitated the development of some direction for schools as a basis for curriculum construction in data processing. This study was conducted to help school administrators and business educators establish some guidelines for curriculums to train prospective data processing employees at the secondary and two-year post high school levels.

Data for the study were collected from four major sources. Interviews were held with managers of data processing departments in industries selected at random throughout the United States. Employees in data processing departments of those selected industries completed questionnaires administered by the interviewers. Information about the schools' offerings in data processing was obtained by interviews with department heads and questionnaires from teachers in schools teaching data processing within a thirty-five mile radius of the businesses interviewed. Interviews with advanced planning executives in computer manufacturing industries gave information on what is being planned and on the drawing boards of those companies that will affect the educational process in data processing in the next three to ten years.

HIGH SCHOOL CURRICULUM IN DATA PROCESSING

The curriculum presented for data processing in the high schools is designed to meet two objectives. First, a student will have enough academic credits to be admitted to college should he decide to attend; and second, a student will be able to enter upon a beginning job in a data processing department upon the completion of the program.

9th Grade

	Units
Mathematics	1
English	1
Social Science	1
Science	1
Typing	1
Physical Education	1

10th Grade

Mathematics	1
English	1
Social Science	1
Science	1
Introduction to Data Processing	1/2
Physical Education	1
*	

11th Grade

Advanced Algebra	1/2
English	1
Social Science	1
Computer Concepts and Systems Development	1
Bookkeeping	1
Physical Education	1

12th Grade

Oral Communication	1/2
Written Communication	1/2
Business Organization and Management	1/2
Human Relations	1/2
Business and Office Procedures and Data Processing Applications	1
Physical Education	1
**	

*Electives:

Introduction to Business
Consumer Economics

**Elective:

Economics

Data Processing Courses

Among the specific topics and concepts to be included in the high school data processing courses, the following are recommended in the suggested courses:

Introduction to data processing (10th Grade-1/2 Unit)

1. History of records systems and manual data processing
2. Tabulating cards and equipment
    a. Card layout and design
    b. Equipment (purposes and operation, excluding panel wiring)
        (1) Key punch and verifier
        (2) Sorter
        (3) Interpreter
        (4) Reproducer
        (5) Accounting machine
        (6) Collator
3. Electronic computer logic
    a. Memory
    b. Input of data
    c. Calculation (arithmetic)
    d. Output
4. Flow charting
5. Computer operation (using a type and model of computer and a symbolic language for which the teacher and student have access)

Computer concepts and systems development (11th Grade-1 Unit)

1. Review of electronic digital computers and principles of data processing
2. Computer logic
3. Logic development through problem solving in general
4. Procedures development
5. Forms design
6. Computer languages (two languages: COBOL and one other, possibly Autocoder)
7. Computer business applications

Data processing applications (12th Grade-1/2 Unit)
(This course should be coordinated with Bookkeeping and Business and Office Procedures)

1. Systems analysis and design
2. Programming essentials
3. Report writing and analysis from computer printout
4. Gaming (simulation)
5. Laboratory (or on a co-op basis)
    a. Forms design
    b. Flow charting
    c. Writing the programs
    d. Operating computer
    e. Debugging
    f. Running of live work

Business and General Courses

Employment in business data processing departments requires more than technical know-how in machine operation. Background in how business is organized, how it operates, and how its records are kept is essential, together with good communications skills and knowledge of human relations. In order to provide these skills and knowledges, general background courses in business and the social sciences are an important part of a data processing curriculum.

Business courses. The course in Business Organization and Management should introduce the student to the business firm through a total systems approach. The approach will interrelate the functional areas of business, such as accounting, management, finance, marketing, and production so that the student will discover that no business activity, no matter how detailed, is an isolated event.

Ideally the Business and Office Procedures course and the Data Processing Applications course should be offered as a block during the last semester of the senior year. By teaching these two courses using the block method, the data processing applications can be closely related to the total business system through a more thorough analysis of the flow of data in a continuous sequence from its origin to its ultimate use.

The Bookkeeping course should be developed with an emphasis upon the use of electronic data processing equipment for compiling the records of a business. The emphasis in this course should be on a systems approach to accounting related to data processing accounting procedures.

General courses. The course in Human Relations should be basically a business psychology course. For some time data processing personnel lived in a world that was basically its own, with its own language. That day has passed, and now the data processing personnel is recognizing that its is a facilitating function for the total success of the business. In order for the employees to be effective in their jobs, they must communicate, orally and in writing, with others in the business; and they must be actively associated with all persons who prepare materials for the data processing activity or who receive materials resulting from the data processing activity. In other words, they must relate to all persons in the business organization; therefore, understanding people and knowing the principles of human relations are very important for the data processing personnel.

The Written Communication course should emphasize expository writing rather than the usual English writing course emphasizing literary or creative writing. The purpose of the course should be the development of the ability to express oneself clearly and tersely in writing. Much business information resulting from data processing is in numerical form and must be interpreted by businessmen for the reader. Report writing needs to be stressed in the written communication course as well as ability to express oneself clearly through business letters, directives, memorandums, etc.

Analysis of the data for this study indicated further that data processing personnel in business need not be sophisticated in mathematics to be successful in automated data processing positions. The mathematics program in the curriculum should take the student through advanced algebra, including concepts of Boolean algebra.

The most important characteristic required of individuals in data processing is that of a logical mind. All instruction in the data processing curriculum should strive to develop logical thinking -- through the use of as many problem solving situations as it is feasible to incorporate in the courses.

POST HIGH SCHOOL CURRICULUM IN DATA PROCESSING*

The data processing program at the post high school level should be designed as a terminal program for persons planning to enter the business office through some data processing position. The program should vocationally prepare the graduate of the program with a marketable skill in data processing. In addition to a beginning skill, he should be prepared to move into higher level data processing jobs with experience and/or further training. The post high school program, in addition to satisfying the specific training in technical aspects of data processing, must include other course work that will enable the worker to advance in his chosen career. Adequate background in communications, mathematics, and human relations are vital to the data processing employee, and are an integral part of the curriculum.

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*Typewriting is considered a prerequisite to this program.

FIRST YEAR

1st Semester:	Units
College Algebra	4
Written Communication	3
Accounting Principles	3
Introduction to Data Processing	4
Principles of Economics	3
	17

2nd Semester:

Data Processing Mathematics	3
Oral Communication	3
Accounting Principles	3
Business Conditions (or Contemporary Economic Problems)	3
Logic and Introduction to Systems Analysis	5
	17

SECOND YEAR

1st Semester:

Business Statistics	4
Psychology	3
Advanced Accounting	3
Introduction to Computer Programming	3
Data Processing Systems	3
	16

2nd Semester:

Principles of Management	3
Human Relations	3
Data Processing Applications and Practicum in Programming	5
Advanced Programming	3
	14

Data Processing Courses

Among the topics and concepts to be included in the post high school data processing courses, the following are recommended in the suggested courses:

Introduction to data processing (1st Year, 1st Semester-4 Units)

1. History of data processing
2. Principles of data processing
3. Overview of unit records
    a. Key punch and verifier
    b. Sorter
    c. Interpreter
    d. Reproducer
    e. Accounting machine
    f. Collator
    g. Principles of panel wiring
4. Card layout and design
5. Electronic computer equipment
    a. Types
    b. Logic
6. Flow charting
7. Elements of programming
8. Laboratory in data processing equipment
9. Number systems

Logic and introduction to systems analysis (1st Year, 2nd Semester-5 Units)

1. Procedures development
2. Forms design (source document)
3. General flow charting
4. Program flow charting and block diagramming
5. Computer logic
6. Analysis of information network systems
7. Coding and condensing data

Introduction to computer programming (2nd Year, 1st Semester-3 Units)

1. Review of computer equipment
2. Principles and theory of digital computers
3. Programming essentials
4. Computer logic
5. Block diagramming
6. Coding and condensing data
7. Purposes and functions of different languages

Introduction to computer programming (continued)

8. Uses of symbolic languages
9. Central processing unit
10. Computer applications
11. Registers
12. Assembly programs and compilers
13. Programming systems
14. Fixed and floating points
15. Macro-generators

Business systems design and development (2nd Year, 1st Semester-3 Units)

1. Identification of system objectives
2. Identification of system requirements
3. Methods for achieving system objectives
4. Development of operating procedures
5. Installation of system for each of the following
    a. Customer order and billing
    b. Customer accounts receivable
    c. Inventory control
    d. Sales information
    e. Payroll
    f. Purchasing and accounts payable
    g. General-ledger accounting

Data processing applications and practicum in programming (2nd Year, 2nd Semester-5 Units)

1. Data processing applications
    a. Payroll
    b. Inventory
    c. Accounts receivable and payable
    d. Sales analysis
    e. Policyholders records
    f. Cost accounting
    g. General accounting
    h. Billing
2. Practicum in programming
    a. Systems
        (1) Analysis
        (2) Design
    b. Programming essentials

Data processing applications and practicum in programming (continued)

2. Practicum in programming (continued)
    - c. Report writing and analysis
    - d. Gaming
    - e. Simulation
        - (1) Forms design
        - (2) Flow charting
        - (3) Writing programs
        - (4) Operating computer
        - (5) Debugging
        - (6) Running live work
    - f. Field project

Advanced programming (2nd Year, 2nd Semester-3 Units)

1. Report generators
2. Macro-generators
3. Assembly programs and compilers
4. Emulators
5. Data scheduling systems
6. Monitors and high level languages
7. Fixed and floating points

Business and General Courses

Much of the philosophy underlying the courses described for the high school level applies also for the business and general courses at the post high school level. Particularly in the Written Communications course, the ideas apply at both levels; the approach for the Bookkeeping course at the high school level applies as well for the Accounting courses at the post high school level; and the philosophy of the Social Science and Human Relations courses at both levels will be the same. The level of materials and methods of instruction in these courses may differ, but philosophically they will be the same.

Since the digital computer operates on repetitive processes using binary number systems, the Data Processing Mathematics course should be designed to include such topics as the concept of an iterative process; solution of simultaneous linear equations; logic; Boolean algebra; number systems, particularly the binary and octal systems; classification of errors in the numerical solutions of a problem, especially the following: error in mathematical approximation, error in the measurement of parameters, truncation errors, round-off errors, and ill-conditioned equations.

The course Logic and Introduction to Systems Analysis should begin with an introduction to logic and an analysis of deductive and inductive problem-solving approaches. Procedures development with emphasis on work analysis and methods would precede the development of procedures for computer applications. Flow charting, block diagramming, and forms design would be included as a preface to analysis of information network systems.

Business Conditions is a vehicle in which economic theory is adapted to practical applications in business. An analysis of the American economy, its development and present condition, should be included. Contemporary economic problems involving the state of the economy and underlying factors affecting the economy should be analyzed.

The objectives of the Business Statistics course are to acquaint the student with the theory of statistics and its application in business today. The student should gain an understanding of the kinds of regularity that exist among random fluctuations. Mathematical models with which to interpret phenomena and predict outcomes of experiments related to practical business problems would be built and used through the use of the computer. Topics covered in such a course are probability; principles of sampling; bivariate data and regression analysis; correlation and the analysis of variance; statistical analysis of time series data; index numbers; forecasting; statistical quality control.

The Principles of Management course recommended is not the usual course offered in business curriculums, but a combination of several course offerings. Topics to be included in this course are types of business; organizational levels; departments in a business; principles of office management; and records management and control.

CHAPTER IV

RELATED LITERATURE

Many efforts have been made to identify problems created by the introduction of integrated data processing into business offices and to determine the educational implications of electronic data processing on the business curriculums in both high schools and colleges. These investigations have explored such areas as the duties of persons employed in the various electronic data processing occupations, the training and personal qualifications necessary to perform these duties successfully, the salaries paid in jobs in different levels, applications for which computers have been used in processing business data, the specialized training programs provided by business, and the types of equipment used. These elements have been studied in the hope that the information thus gathered would prove helpful in curriculum development in business education at both the high school and college levels.

However, when viewed as a whole, the literature in data processing has produced but little information that might serve as guides to schools in making decisions about the feasibility of having data processing programs in their institutions. Neither have the studies provided conclusive information that would help in deciding what offerings to include in a data processing program if it were to be part of a business education curriculum.

On only one point, however, do the studies agree somewhat; namely, that people in the management positions in data processing departments need at least four years of college work. However, for the lower echelons of management (supervisory levels) the findings are inconclusive.

In 1957, the Department of Labor (22) studied adjustments of employees to the introduction of office automation to determine the extent of displacement and reassignment of office employees as well as the characteristics of the employees whose jobs were eliminated and the practices in transferring, retraining and selecting employees for the new occupations. The report indicated that in offices into which automated data processing had recently been introduced, 42 per cent of the people had completed some college work or had graduated; however, 78 per cent of the newly hired employees had this amount of education. Goodman (12), four years later, reported that a survey of 100 data processing personnel in Los Angeles revealed that 30 per cent of the specialists in data processing and management had four years of college work.

Generally the specialized training on machine operation, from key punch through computer console operation, was commonly thought to be provided best by either the employing company or by the equipment manufacturer. Later studies (2,10,11,15,17) seem to show a slight trend toward hiring trained people from high schools, junior colleges and other post high school institutions for some of the machine operating jobs; however, the businesses who hired them then provided training in the special applications needed for their own purposes in a brief in-service training program.

Whether or not this is a trend is not clear, since in most of the studies the data were gathered before many educational institutions offered training in data processing. Perhaps because so few data processing programs were in existence at the time these studies were done, no real attempt was made to evaluate the effectiveness of the education and training provided or to draw many curricular implications.

Backlund, Dudley, Edwards, E. D. Gibson, and G. Gibson (1,3,7,9,10) conducted studies to determine the types of programs that should be offered in data processing at the collegiate baccalaureate level. Gibson (9:210) concluded that a four-year college degree was necessary for systems analysts; that it is helpful, but not essential, for the data processing manager and programmer; and that a high school graduate can easily obtain employment in the electronic data processing office as a console operator or a key punch operator. Further, Gibson reported that 63 per cent of the businessmen in her study, 103 businessmen belonging to the Boston Chapter of the Data Processing Management Association, hire only college graduates for the position of systems analyst; that 56 per cent hire only college graduates for the position of operations manager; that 33 per cent hire only college graduates for the position of programmer. Gibson further reports that 84 per cent of the businessmen hire high school graduates for the position of console operator and that 92 per cent hire high school graduates for the position of key punch operator (10:195-205). Participants in Gibson's study recommended the following high school courses for prospective data processing employees: typewriting, general business, operation of key punch machine, bookkeeping, operation of ten-key machine, operation of calculator, and operation of computer console (10:67).

Korn (17) constructed a standardized objective achievement test for the course Introduction to Business Data Processing that could be used as a means of evaluating a student's progress toward achieving the objectives of an introductory course in business data processing in a post high school program. Korn compiled a list of topics through textbook analysis and interviewing procedures to ascertain the units usually covered in a post high school course entitled Introduction to Business Data Processing. The list of topics compiled is as follows:

History of data processing
Purpose and function of unit record equipment
Input/output media and devices
Primary storage and retrieval
Arithmetic and logic functions of the computer
Control unit
Introduction of programming
Total systems concept

In spite of the fact that much effort has been expended in investigation of the educational implications of automation in the office, nothing conclusive has been produced. The studies tend to be unreliable because of the biased samples. The findings cannot be generalized either because the studies are extremely localized geographically or because of the inadequate sampling procedures.

Consequently, business educators know relatively little more about what to teach in and about data processing, or when and where to teach it. Thus, the present study was designed to supply information, not only about what business actually needs by way of qualified data processing employees, but also to provide a basis for evaluating current instructional programs in data processing offered in public educational institutions. The investigator in only one of the studies (5) interviewed the employees at all levels of data processing about the training they had. However, no indication is given that they were asked to evaluate what they had studied in the data processing programs in which they received their training.

This study, therefore, surveyed (1) business about its needs for data processing employees and the educational and personal qualifications they should possess, as well as about its evaluation of the products of data processing programs in public schools; (2) data processing employees about the training they have had and the adequacy of that training; (3) data processing equipment manufacturers about new developments anticipated in machines and procedures (scanning devices, program oriented languages, etc.) and their possible influence on the training and qualifications necessary to work with the devices being developed for the future; and (4) public educational institutions about current offerings in data processing and about the students who are taking advantage of what is offered.

CHAPTER V

PROCEDURES

This study was designed as an attempt to determine the implications of automated data processing for the preparation of office workers by public secondary schools and post high school institutions offering less than the baccalaureate degree. Data were gathered about data processing employees, from them and from the managers of the departments in which they were employed. Further data about the status of data processing instruction in the schools was gathered from heads of instructional units in high schools, junior colleges, and vocational-technical schools and from teachers of data processing courses. In order to determine what lies in the future in technological developments in data processing equipment, interviews were held with executives in the advance planning departments of leading computer and other data processing equipment manufacturing companies.

A sample survey design utilizing interviews and questionnaires was used for this study because of the kind of information needed. Also, because data were needed at the national level in order to determine common elements that may serve as a basis for curriculum development in business education departments over the country, teams of trained interviewers operating in seven areas of the United States collected data from the schools and offices concurrently. Interviews, rather than a mailed questionnaire, were the main means of collecting data since much of the data needed was of the type that could best be gathered with open-end questions and also because of the greater probability of a higher rate of response.

The factual information gathered on the questionnaires served as a point of departure for interviewers to probe more completely into motivations of the people involved, their evaluations of training programs, and their departmental plans for the future. Since characteristics of existing programs were not known (relatively new programs are the rule), interviews of school data processing teaching personnel permitted collection of more precise information regarding program content.

The interviewers used a prepared schedule of questions to gather information from data processing management personnel regarding the educational and skill requirements of data processing personnel. Information was gathered from the management personnel about promotion patterns, working conditions, characteristics of the people employed in various data processing jobs for the various job categories, and trends in the data processing field in general and in his own business.

The interviewers asked prepared questions of each of the data processing managers in 353 businesses and recorded the answers on the schedule provided to the interviewer. Insofar as possible, the questionnaire prepared to gather information from the employees was administered personally by one of the members of the interviewing team at the same time that the other member was interviewing the data processing manager. In a few companies the interviewers were asked to leave the questionnaires for the employees to fill out at their leisure. These questionnaires were then mailed directly to the study headquarters at Colorado University in Boulder.

PREPARATION OF THE QUESTIONNAIRES

Preliminary forms of the questionnaires were prepared and were tried out to evaluate the wording of the questions, the length of time required to complete the questionnaire, and for omissions of information that should have been included in such a study. The tryouts were conducted in the Denver area using as interviewees three data processing managers who were willing to cooperate. From the suggestions given by these men and from the observations of the research team, the questionnaire format was revised, wording was refined, and other suggestions were incorporated into a shorter, less cumbersome format, which was again tried out with the same interviewees. With minor revisions, the management interview schedule was prepared as well as the employee questionnaires (see Appendix B-1 and B-2).

The same procedures were followed in the preparation of the schedules used in interviewing the heads of data processing departments in the secondary schools, the junior colleges, and the technical schools that were included in the study (see Appendix B-3 and B-4).

SELECTING AND TRAINING THE INTERVIEWERS

Brochures were prepared announcing the need for interviewers to gather data for a national curriculum study in data processing. These brochures were distributed to all graduate deans in schools of business and to heads of business education departments in schools offering graduate programs in business education. Announcements were also made and prospective employees solicited at national and regional business education conventions.

Applications were received from 35 people from whom 14 interviewers were finally selected on the basis of data processing and/or business teaching experience (see Appendix C-1).

A three-day training session was held at Colorado University Business School on September 16 to 19, 1966, in which interviewing techniques were discussed, and during which the interviewers were provided opportunities to practice using the management interview schedule, actually using data processing managers as subjects. General instructions regarding the study were given, appointments for the first two weeks of the interviews with business firms were made, and itineraries were provided to each team of interviewers, who then began their interviews on September 21, 1966.

SELECTION OF THE SAMPLES

Three different populations were to be studied in this investigation: businesses using either mechanical or electronic data processing, employees in data processing departments of these companies, and public high schools or junior colleges and/or technical schools.

Selecting the Businesses

Dun and Bradstreet's 1963 Million Dollar Directory (4) listed some 28,000 businesses with net worth of one million dollars or more. This list constituted the population from which the sample of data processing equipment users was to be drawn since businesses of this size were the ones likely to be utilizing such equipment. Since such equipment represents large capital investment, larger companies were used as the source of information for the problem under investigation.

The N.E.A. small-sample formula (19)

$$n=\frac{X^2\ Npq}{d^2(N-1) + X^2\ pq}$$

was to be used for determining the size of sample necessary to draw conclusions applicable to the entire population of businesses. Application of this formula shows that a sample of approximately 285 businesses would constitute a sample sufficient to provide 95 per cent reliability, with no more than 5 per cent error in the statements made on the basis of the sample.

However, since no information was available about the proportion of businesses listed in the Dun and Bradstreet Million Dollar Directory that had data processing installations, the decision was made to conduct a preliminary post card survey of a small sample of businesses to determine the kinds of computing and calculating machines and equipment used in their offices. Thus, a systematic random sample of 200 names was selected from the Directory. The returns from this brief questionnaire indicated that approximately 60 per cent of the businesses had data processing equipment, either unit record systems or computer systems. On the basis of this information, the decision was made to have the publishers of the Directory draw a systematic random sample of 500 businesses from their listing of million-dollar businesses. Dun and Bradstreet furnished the list printed on cards, together with the addresses and the standard industrial classification of each of 500 businesses.

Each interviewing team was supplied with a list of names of companies located in the particular geographic region to which the team was assigned. They were to contact the companies by telephone to determine whether or not they had either a mechanized or automated data processing department, and if so, to arrange an appointment to talk with the data processing manager. The teams were instructed to interview all companies on their list that had data processing installations, with or without computers. Consequently, some teams conducted more than 45 interviews since more than 60 per cent of the companies on their list had installations. The interviewing teams talked with data processing managers in 353 businesses. Six teams reported one refusal each, and the other team reported two refusals by the firms they contacted. Thus, approximately 98 per cent of the companies contacted agreed to talk with the interviewers. In most cases, the refusals were due to the fact that the companies were in the midst of a change-over from one computer to another or were converting from a unit record system to a computer system so the data processing manager was not available. Most of the companies invited the interviewers to come back at a later date, but this was impossible because of the distances involved and the time limits within which the teams had to work (see Appendix C-2 for list of companies interviewed).

Description of the Sample

Of the 353 data processing installations studied, 275 used computers and 78 had only unit record equipment. The businesses were located in 39 states and 148 cities. Table 5-1 shows how the businesses in the sample were distributed throughout the regions of the United States compared with the distribution of companies surveyed by the DPMA in their annual data processing salary survey (3).

Although an analysis showed that the two distributions were not the same, no information is available about the proportion of the return that the 2,324 businesses in the DPMA survey represents nor was any information given about the number of businesses to whom questionnaires were sent. The DPMA does not make clear in their report whether any of the data processing installations in their study were operating with no computer, while in the present study 78 of the 353 (22 per cent) of the data processing departments were unit record installations.

Since the Dun and Bradstreet Directory constituted the source of the sample selected for this present study, no government or educational installations were included in the present study.

Table 5-1. Geographic Distribution of Businesses in the Sample

Area	DPMA Sample Salary Survey 1966		Current Study Sample	
	N	%	N	%
New England	195	8.4	35	9.9
Middle Atlantic	455	19.6	60	17.0
South Atlantic	262	11.3	30	8.5
East South Central	53	2.3	12	3.4
West South Central	118	5.1	42	11.9
East North Central	598	25.7	80	22.7
West North Central	267	11.5	36	10.2
Mountain	83	3.6	19	5.4
Pacific	293	12.6	39	11.0
Total	2324		353	

The companies were classified according to the major SIC categories and Table 5-2 shows how they were distributed into these classifications. (For a more detailed summary of the distribution of the kinds of businesses in the regions of the country, see Appendix C-3).

Table 5-2. Distribution of Businesses by Standard Industrial Classification

Type of Industry	Number
Agriculture, forest, and fisheries	2
Mining and petroleum	10
Contract construction	5
Manufacturing	158
Transportation, public utilities, communication	32
Wholesale, retail	54
Finance, real estate, insurance	79
Service industries	13
Total	353

Size of the companies. The businesses ranged in size from relatively small companies with under 40 employees to companies with over 3,000 employees. The sizes of the data processing departments varied greatly, with 14 companies (with computer installations) reporting between 1 and 4 data processing employees and 7 companies in which over 290 employees worked in the data processing department (Table 5-3). The median number of employees in data processing departments in the present study was 19. This was approximately the same as the median number reported by DPMA in the 1966 data processing salary survey (5). An analysis revealed that the differences between the two distributions of sizes of data processing departments are no larger than could be accounted for by chance.

Table 5-3. Number of Data Processing Employees in Companies with Computer Installations
(% of Companies Employing Reported Number of Employees)

Employees	Companies N=275	DPMA Sample N=2324
1-4	5.09	4.1
5-9	19.27	16.3
10-17	24.00	20.5
18-30	18.91	19.6
31-50	16.36	15.8
51-80	4.73	9.6
81-125	5.82	6.9
126-192	2.18	3.5
193-290	1.09	1.7
Over 290	2.55	2.0

The percentage of employees in data processing in the businesses selected for this study compares favorably with the number of data processing employees who completed the questionnaires left with them (Table 5-4).

Table 5-4. Number of Data Processing Employees in Businesses Interviewed and Employee Questionnaires Returned

	Total Employees		Questionnaires Returned	
Job Title	N	%	N	%
Key punch operator	4,312	40.4	835	39.0
Tape librarian	205	2.0	26	1.2
Unit record equipment operator	1,618	15.2	373	17.4
Computer operator	1,347	12.6	275	12.9
Programmer	2,114	19.8	332	15.5
Data processing supervisor	531	5.0	160	7.5
Systems analyst	544	5.1	138	6.5
Totals	10,671		2,139	

When an analysis of the proportion of men to women in data processing jobs was made, comparing the total number of data processing employees in the 353 businesses and the number of questionnaires returned from each job category, a discrepancy is noted only in the job of tape librarian (Table 5-5). The information supplied by the 26 librarians who completed the questionnaire revealed that 22.5 per cent of them were men whereas the total number of male tape librarians in the 353 businesses was 34.1. This may perhaps be explained by the small number of tape librarians (only 70) in all of the companies surveyed.

Table 5-5. Proportions of Men and Women Employed in Data Processing Jobs, by Total Employed in Businesses Interviewed and by Employee Questionnaires Returned

Job Title	Total Employed					Questionnaires Returned				
	Men N	%	Women N	%	Total	Men N	%	Women N	%	Total
Key punch operator	67	1.6	4,245	98.4	4,312	17	2.0	818	98.8	835
Tape librarian	70	34.1	135	65.9	205	3	11.5	23	88.5	26
Unit record equipment operator	1,030	63.6	588	36.4	1,618	210	56.3	163	43.7	373
Computer operator	1,213	90.1	134	9.9	1,347	226	82.2	49	17.8	275
Programmer	1,749	82.7	365	17.3	2,114	273	82.2	59	17.8	332
Data processing supervisor	487	91.7	44	8.3	531	149	93.1	11	6.9	160
Systems analyst	502	92.3	42	7.7	544	130	94.2	8	5.8	138
Totals	5,118	47.9	5,553	52.1	10,671	1,008	47.1	1,131	52.9	2,139

Size of data processing installations. In comparing the distribution of the number of companies according to the monthly rental spent for data processing equipment, the present sample seems to have in it more smaller installations than did the DPMA 1966 salary survey sample (Table 5-6).

Table 5-6. Monthly Rental for Total Data Processing Equipment

	Total Companies N=300*		Companies with Computers		DPMA Sample N=2324
Dollars	N	%	N	%	%
Up to $3,000	94	31.33	28	12.33	14.2
$3,001-6,000	67	22.33	62	27.31	18.5
$6,001-12,000	74	24.67	72	31.72	25.3
$12,001-25,000	31	10.33	31	13,66	19.8
$25,001-50,000	15	5.00	15	6.61	12.0
Over $50,000	19	6.33	19	8.37	10.1

*Fifty-three of the businesses reported that they own their data processing equipment or have some other arrangement (leased-time, etc.) for use of data processing equipment.

This is perhaps due to the number of unit record installations reported in the present sample since omitting the unit record installations makes the distribution more like that reported by DPMA. Considering only computer installations, the median rental falls in the $6,000-12,000 bracket, which is also the median category of the DPMA sample.

When data processing departments were categorized according to computer rental (Table 5-7), the present sample seems to include a greater proportion of smaller computers than does the DPMA sample, although the median computer rental for both samples falls in the $6,000-12,000 category.

Table 5-7. Monthly Computer Rental

Dollars	Current Survey		DPMA Survey
	N	%	%
Up to $3,000	42	19.4	9.6
$3,001-6,000	61	28.2	21.7
$6,001-12,000	56	25.9	28.4
$12,001-25,000	29	13.4	19.6
$25,001-50,000	9	4.2	11.3
Over $50,000	19	8.8	9.4
Total	216*		2,422

*Sample includes only those companies actually renting computers and excludes those that owned them or had other arrangements for using computers.

Types of equipment in data processing installations. The companies visited reported using a variety of equipment, both in unit record and computer installations (Table 5-8). Apparently, because of the amount of input which can be processed by the computers, each computer installation had almost four times as many key punches as did the unit record installations. Reflecting the importance of accuracy in computer input, verifiers were used to a greater extent in computer installations than in unit record installations.

In comparing the number of computers and other peripheral equipment in the present study with figures published in the 1968 DPMA salary survey (6), the greatest difference seems to be in the number of disc packs and tape drives reported in the two samples. The businesses in the present study reported 5.4 disc packs per installation, but the DPMA report indicated 1.7 disc packs in each computer installation. The situation is reversed for tape drives, in that less than one tape drive was reported per installation in the present study, and the DPMA study shows nearly four tape drives per company.

Table 5-8. Number of Pieces of Data Processing Equipment

Equipment	Current Survey				DPMA 1968(6) Survey
	Companies with Computers N=275		Companies without Computers N=78		
	Total	Per Company	Total	Per Company	Per Company
Key punch	2,770	10.7	209	2.7	
Verifier	1,271	4.6	66	0.8	
Card sorter	590	2.1	100	1.3	
Reproducer	330	1.2	75	0.9	
Collator	384	1.4	78	1.0	
Accounting machine	338	1.2	85	1.1	
Interpreter	199	0.7	26	0.3	
Calculating punch	40	0.1	44	0.6	
Card reader	364	1.3	11	0.1	
Paper tape equipment	292	1.1	7	0.1	
Computer	524	1.9			1.7
Disc pack	1,489	5.4			1.7
Disc drive	123	0.4			0.8
Data converter	67	0.2			
Tape drive	209	0.8			3.9
Printer	442	1.6			1.6
Magnetic tape typewriter	23	0.1			
Optical scanner	18	0.1			0.1

Selecting the Schools

The person in charge of the data processing instructional program was interviewed in the secondary school system in each community in which business interviews were conducted. Also, the person in charge of business data processing was interviewed in any area vocational-technical school and in any public junior college located within a 25-mile radius of the city in which a selected business was situated. Besides interviewing the person in charge of the data processing programs, he and any other data processing teachers were asked to fill out a personal and educational information questionnaire. These questionnaires were either filled out while the interviewer was visiting the institution or they were left for the teachers to complete later and were to be returned by mail as soon as they were completed. Questionnaires were received from 477 data processing teachers in 176 school systems (see Appendix C-4).

PRELIMINARY STUDY OF DATA PROCESSING EDUCATION

Prior to sending the interviewers to the schools to interview data processing instructional staff, a census survey was planned and conducted, utilizing a one-page optical scanning questionnaire asking whether or not the school offered any data processing courses or whether they were planning any data processing instruction in the next three years, with a brief section in which they could indicate the kinds and extent of instruction offered or planned.

Prior to sending out the optical scanning form, the questionnaire was revised twice and 10 high schools, 10 junior colleges and 10 area vocational-technical schools were asked for criticism and suggestions. Personnel in data processing programs in Denver and the surrounding areas also supplied suggestions. Of the 27 questionnaires sent out, 27 were returned with appropriate comments (see Appendix B-5).

The optical scanning form was sent to all high school districts in the United States, except in Hawaii and Alaska, to all public junior colleges, and to all area vocational-technical schools.

The population of high schools was all secondary school districts listed in the 1964 Directory of Secondary School Districts (21). The junior college list was taken from the 1965 World Almanac.

No current list of area vocational schools was available, so a letter was written to each of the state directors of vocational education in each of the states, asking for a list of the public vocational schools in his state, together with the name of the administrator of that school.

All questionnaires were addressed to the chief administrator of each school. A total of 10,885 questionnaires was mailed, of which 10,278 (94.4 per cent) were returned.

PART II

CHAPTER VI

KEY PUNCH OPERATOR*

More than 98 per cent of the key punch operators in the businesses contacted in this study were women, who had found their jobs primarily through school contacts, advertising, and through efforts of private employment agencies.

CHARACTERISTICS OF KEY PUNCH OPERATOR'S JOB

The key punch job may be classified in the general clerical or office machines category in which the primary duty of the employee is operation of the key punch machine. Other duties, however, are performed by these people. Over a fourth of the key punch operators indicated that they verified punched cards, operated interpreters, sorters, and reproducers. Several of the key punch personnel also operated typewriters, collators, and accounting machines. About 11 per cent of them did some supervisory work and had some clerical duties.

Work Experience Required

Key punch operators can obtain jobs if they have had as little as six months of experience in data processing (Table 6-1). This opinion was expressed by 82 per cent of the managers, although 15 per cent of them would not accept for employment applicants with less than six months experience in the past. However, over 62 per cent of them would prefer more than that amount of experience and nearly 29 per cent would prefer that applicants for the key punch job have at least a year or more of experience before hiring them.

Educational Requirements

Data processing managers indicated that a high school education was sufficient for key punch operators, and since almost all (95 per cent) of them had completed at least this amount of education, apparently the educational level preferred by the managers is being satisfied. However, about 30 per cent of the management personnel interviewed said they would like to have key punch operators with some additional training either in a specialized school or in junior college or vocational school after high school graduation.

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*The job description of key punch operator is based on the data collected in this study and previously displayed and analyzed in earlier chapters of this report.

Table 6-1. Amount of Data Processing Experience Prior to Employment as a Key Punch Operator
(% of Managers Indicating Stated Amount)

Months	Minimum Acceptable	Amount Preferred
0 - 6	82.2	37.9
7 - 12	14.9	34.4
13 - 24	2.6	19.2
25 - 36	0.0	6.1
More than 36	0.3	2.3

General education. When managers were asked to list general areas of study they felt would be beneficial for key punch operators, they listed communications as being of prime importance, both written and oral, along with algebra. To a lesser extent they suggested psychology and logic as good background for these employees.

The employees themselves were asked to list general high school courses which they considered helpful in their work, and they were in agreement on the importance of such courses as general and advanced mathematics, English and social science. Mathematics and English were areas in which such employees felt they could profit by more training.

Key punch operators with some post high school training felt they should have training in about the same background courses as in high school, general mathematics, English, and psychology; and they also, to a certain extent, noted a need for advanced mathematics.

Business courses. Among high school business courses of most value to key punch operators in their job, typing (66.3 per cent) ranked highest by a great margin, although some of the responses indicated that bookkeeping and introduction to business were helpful courses.

Shorthand was listed most frequently as the least helpful course, and about 10 per cent of the key punch operators listed bookkeeping as not helpful; about 3 per cent of them felt that they had little help from introduction to business.

In the business skills, the people with some post high school training pointed out a need for knowledge of data processing equipment, typing, and to a certain extent, calculating machines; some listed accounting principles and business mathematics as desirable business background. At this level, too, shorthand was considered by these people to be their least helpful course.

Management responses regarding high school business courses these employees should study indicated key punch and typing to be most important (87 per cent). About half this number of the managers felt that these employees should also have some background in concepts of data processing, and about a third of the managers felt that prospective key punch operators should have some experience with other unit record equipment. More generally speaking, however, management would like to hire key punch operators with training in introduction to business, records management, or office management.

Promotion, Supervision, Overtime, and Salaries

The key punch operator's chance for advancement is relatively low; over 60 per cent of the managers indicated these employees have a low probability to little or no chance for promotion. They tend to be promoted to the position of unit record equipment operator, with about half as many managers indicating they might become computer operators, provided they had sufficient interest and aptitude.

Key punch operators work under considerable supervision, with supervision provided continuously or several times a day. More than half of the firms reported that their key punch operators average up to 3 hours of overtime a week, and between 15 and 20 per cent of them indicated that key punch operators might work as much as 7 hours a week overtime.

The median monthly salary for key punch operators was $340 (Table 6-2). Out of 835 key punch operators in the study, 27 reported salaries under $200 a month, a little more than 30 per cent of the girls reported that their monthly salary was between $200 and $299; but 23 reported salaries of over $600 a month, with 13 of them receiving as much as $1,000. However, six of the highest paid operators had been with their companies for more than ten years, and ten of them had been there over five years.

Apparently education has less influence on salary than does experience in data processing (Tables 6-2 and 6-3). The median salary is about the same for key punch operators with different amounts of education. However, for those with less than three years of experience and for those with more than ten years, the medians are below and above the median for the entire group. For those with less than one year of experience in data processing jobs, the median salary is less than $300 a month, $310 for those with one to three years of

Table 6-2. Salaries Paid Key Punch Operators According to Levels of Education

Salary	Less than High School	High School	Post High School	Degree	Total
Under $200	4	16	7		27
$200-299	8	133	119	1	261
$300-399	17	174	140	4	335
$400-499	10	95	51		156
$500-599	1	20	11	1	33
$600-699	1	4	2	1	8
$700-799		1			1
$800-899					0
$900-999				1	1
$1,000+	1	9	3		13
Totals	42	452	333	8	835

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Table 6-3. Salaries Paid Key Punch Operators According to Amount of Data Processing Experience

Salary	Under 1 Year	1 - 3 Years	3 - 5 Years	5 - 9 Years	10 Years or More	Total
Under $200	15	5	2	3	2	27
$200-299	127	76	30	19	9	261
$300-399	42	68	85	88	52	335
$400-499	3	21	20	57	55	156
$500-599			1	12	20	33
$600-699	1	1			6	8
$700-799					1	1
$800-899						0
$900-999					1	1
$1,000+	2		1	4	6	13
Totals	190	171	139	183	152	835

experience. Those with three to ten years of data processing experience are paid about the median salary although the range of salaries for this group goes up as high as $1,000 a month. Those with ten years or more of experience have a median salary of about $425 a month.

DATA PROCESSING TRAINING

Generally speaking, key punch operators had had some training prior to entering the data processing field, although management seemed to provide considerable on-the-job training for these people to supplement their school training.

Training Prior to Entering the Data Processing Field

Executives who responded regarding the type of data processing training for key punch operators prior to their entering employment, indicated that such training might best be secured at school in key punch, typing, and concepts of data processing.

The employees themselves indicated that prior to taking a job in the data processing field, their main source of training (75 per cent of it) was the special data processing school or manufacturers' classes where they learned such skills as key punching and operation of unit record equipment (Table 6-4). Those who indicated having had data processing courses in high school named key punch, data processing concepts and unit record equipment operation as the major areas studied, with more of them having received training on unit record equipment than in key punching.

Key punch operators under the age of 21 received such training in high school classes to a greater extent than did older employees. Those from 26 to 30 years of age tended to have received such training in the special data processing schools or in private business schools. As the age of the key punch operators rises, the proportion of them who have received training in a manufacturers' school prior to entering data processing work also rises.

Training After Entering Data Processing

Of the training provided by management after they entered their jobs, most of the key punch operators indicated they were trained on the job (Table 6-5). To a considerably lesser extent, key punch operators were sent by their employers to the manufacturers' schools. Over 77 per cent of the training in data processing listed by the operators themselves was received on the job, not only in key punching, but again more of it in unit record equipment.

Table 6-4. Training and Place of Training of Key Punch Operators in Data Processing Prior to Entering the Field

Training	High School	High School Part-time	College	Special Data Processing School	Private Business School	Equipment Manufacturing	Military	Place Not Given	Total
Key punch simulator	2	0	0	17	10	6	2	2	39
Key punch machine	32	8	19	148	10	123	5	17	362
Card sorter	15	10	6	75	30	27	4	12	179
Unit records	67	17	25	153	59	83	14	22	440
Wiring boards	10	2	5	34	13	12	1	4	81
Console operation	1	0	2	4	3	5	1	0	16
Access devices	0	0	0	1	0	0	1	0	2
Data converting	0	0	2	2	1	0	2	0	7
Paper tape equipment	5	0	2	3	1	3	2	0	16
Data processing concepts	41	0	20	64	26	19	5	0	175
Programming	5	0	4	15	3	8	0	0	35
Totals	178	37	85	516	156	286	37	57	1,352
Per Cent	13.1	2.7	6.3	38.1	11.5	21.1	2.7	4.2	

Table 6-5. Training and Place of Training of Key Punch Operators in Data Processing After Entering the Field

Training	Company's Classes	Manufacturer's School	Manufacturer's Representative	Local School	On-the-Job	Sent to Local School	Other	Total
Key punch simulator	1	5	1	0	27	5	3	42
Key punch machine	17	51	13	23	378	41	14	537
Card sorter	9	9	7	7	277	2	5	316
Unit record	45	31	17	20	891	9	22	1,035
Wiring boards	4	11	3	3	108	3	6	138
Summary punch	1	6	0	1	66	1	1	76
Console operation	2	4	3	0	29	0	2	40
Access devices	0	2	0	0	12	0	0	14
Converting equipment	0	0	2	0	15	0	1	18
Paper tape equipment	7	0	2	2	25	0	2	38
Data processing concepts	3	9	4	18	19	8	5	66
Programming	1	5	0	7	3	3	2	21
Data processing applications	2	0	0	1	17	1	0	21
Accounting	1	0	0	10	14	2	4	31
Management	3	1	1	5	11	4	3	28
Other business courses	2	0	0	4	7	6	0	19
Totals	98	134	53	101	1,899	85	70	2,440
Per Cent	4.0	5.5	2.2	4.1	77.8	3.5	2.9	

Evaluation of Their Educational Preparation

In general, over 75 per cent of the key punch operators indicated that their education had adequately prepared them for their jobs or had prepared them very well. However, those with some data processing background in their educational experience were considerably more satisfied with their preparation than the others, with only 9.5 per cent of the trained key punch operators saying their preparation was inadequate.

DATA PROCESSING EXPERIENCE

Most of the employees who had been with their companies less than three years apparently had received all their data processing experience in their present company, since 496 of the key punch operators had been with their companies up to three years; only 361 of them had had as much as three years of experience in data processing jobs (Table 6-6).

Table 6-6. Amount of Experience Reported by Key Punch Operators

Amount of Experience	In Data Processing	Total with Present Company
Up to 1 year	190	282
1 - 3 years	171	214
3 - 5 years	139	113
5 - 9 years	183	125
10 or more years	152	101
Total	835	835

Most of the key punch operators indicated that their only data processing experience was in key punching; about 8 per cent of them had worked as tab operators or had done some supervisory work previously.

Key punch operators who had had other types of experience in business offices indicated they had work in general clerical work (29 per cent), sales and service occupations (23.7 per cent), stenographer-typist (16.2 per cent), and in accounting work (7.8 per cent). About 8 per cent of the key punch operators had also done factory work.

CHARACTERISTICS OF KEY PUNCH OPERATORS

Key punch operators were characterized by data processing managers as being people who like routine, who like to know just exactly what they are to do and how to do it; they are relatively stable emotionally and can work under pressure, an important characteristic since data processing personnel are frequently called on to do rush jobs and do work under pressure.

The leisure time interests of these people are rather wide, with the greater number of them indicating interest in the arts and crafts, reading and participating in sports, and to some extent in hunting and camping. They think puzzles are "O.K.," but over a sixth of them said they hated puzzles, which was considerably greater proportion than in any other job category.

ATTITUDES TOWARD DATA PROCESSING AND THEIR JOBS

Generally speaking, key punch operators enjoy working in the data processing field and plan to remain in it, with nearly 90 per cent of them expressing their satisfaction with the field (Table 6-7). The proportions of people who stated that they enjoyed the field was the same whether or not they had had data processing training before entering the field.

Key punch operators felt that their work was interesting, and they liked their co-workers as well as the type of their job. Too, they felt that the work experiences they had were valuable and varied and that their working conditions were good.

However, certain features of the job were a source of dissatisfaction to the key punch operators. Among the dissatisfactions were the rush jobs that caused them to have to work under pressure, the monotony and certain physical aspects of the job ("having to sit eight hours a day" and the noise).

Table 6-7. Attitude of the Key Punch Operator Toward Data Processing Work

Training	Enjoy-Will Remain		Enjoy-Desire Change		Dislike-Will Remain		Dislike-Desire Change		Total
	N	%	N	%	N	%	N	%	
Without training	340	89.7	28	7.4	8	2.1	3	0.8	379
With training	388	89.4	30	6.9	12	2.6	4	0.9	434
Totals	728	89.5	58	7.1	20	2.5	7	0.9	813

SUMMARY

JOB: Key Punch Operator

Duties:

1. Punch Cards

2. Verify Punched Cards

3. Operate
    a. Interpreter
    b. Sorter
    c. Reproducer
    d. Collator
    e. Accounting Machine
    f. Typewriter

4. Supervise Key Punch Operators

5. Clerical Duties

Supervision Required:

Several Times Daily

Education:

Minimum: High School

Desired: High School

General Courses (High School):
1. General Math
2. Advanced Math
3. English
4. Key Punch Machine
5. Typing
6. Data Processing Theory
7. Unit Record
8. Oral and Written Communications
9. Algebra
10. Psychology
11. Logic and Philosophy
12. Social Science

Education (continued):

Business Courses (High School):
1. Introduction to Business
2. Record Management
3. Office Management
4. Typing
5. Bookkeeping
6. Office Procedures
7. Business Math

General Courses (Post High School):
1. General Math
2. English
3. Psychology

Business Courses (Post High School):
1. Data Processing Equipment
2. Typing
3. Calculating Machines
4. Accounting Machines
5. Business Math

(Shorthand, Business English and Report Writing were least helpful)

Experience:

Minimum: 3 Months or Less

Desired: 6 Months to 1 Year

Personal Characteristics:

1. 98% are women.
2. Jobs attained through schools, advertising, and private employment agencies.
3. Like routine work and be able to work under pressure.
4. Enjoys her work and desires to remain in it.
5. Generally feel their education adequately prepared them for their jobs, especially those who had training in data processing.
6. Like best the type of job they are doing; dislike having to do rush jobs.

Personal Characteristics (continued):

7. Hobbies are arts and crafts, participation in sports, and reading. Puzzles are "okay."

8. The median age is 25 years.

Promotional Probabilities: Low

Promoted to Unit Record Operator, Supervisory and Computer Operators.

Education has little or no effect upon promotion.

Salary:

Median:	$340
Men:	$450
Women:	340
Less than 1 Year Experience	Less than $300

CHAPTER VII

TAPE LIBRARIAN*

The number of tape librarians in this survey was small (26 people). Sixty-five per cent of the tape librarians were women who had found their jobs primarily through answering advertisements, through promotion, and through friends.

CHARACTERISTICS OF TAPE LIBRARIANS

The tape librarian may be classified in the general clerical or office machines category in which the primary duty of the employee is filing and registering tapes. Over forty per cent of the tape librarians indicated that they punched cards, verified punched cards, and performed clerical duties. A few of the employees also operated sorters, typewriters, and interpreters in addition to conferring with people concerning computer time for tape runs.

Work Experience Required

Tape librarians can obtain jobs if they have had as little as six months of experience in data processing (Table 7-1). This opinion was expressed by 86 per cent of the managers. However, 57 per cent of the managers would prefer more than six months of experience and nearly 25 per cent would prefer that applicants for the tape librarian job have at least a year or more of experience before hiring them.

Educational Requirements

Data processing managers indicated that a high school education was sufficient for tape librarians (95 per cent), and since almost all the tape librarians (96 per cent) had completed at least this amount of education, apparently the educational level preferred by the managers is being satisfied. However, about 27 per cent of the management personnel interviewed said they would like to have tape librarians with some additional training after high school graduation.

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*The job description of a tape librarian is based on the data collected in this study and previously displayed and analyzed in earlier chapters of this report.

Table 7-1. Amount of Data Processing Experience Prior to Employment as a Tape Librarian
(% of Managers Indicating Stated Amount)

Months	Minimum Acceptable	Amount Preferred
0 - 6	86.0	42.2
7 - 12	7.8	32.8
13 - 24	4.7	20.4
25 - 36	1.6	4.7
More than 36		

General education. When managers were asked to list general areas of study they felt would be beneficial for tape librarians, they listed communications as being of prime importance, both written and oral, along with algebra. To a lesser extent they suggested logic and social science as good background for these employees.

The employees themselves were asked to list general high school courses which they considered helpful in their work, and they were in agreement on the importance of such courses as general and advanced mathematics and English.

Tape librarians with some post high school training felt their training in English had been the most helpful.

Business and data processing courses. Among high school business courses of most value to tape librarians in their jobs, typing (38 per cent) and introduction to business (27 per cent) ranked highest. Shorthand and bookkeeping were listed most frequently as the least helpful courses.

In the business skills, the people with some post high school training pointed out that typing was the most valuable course for them. Data processing equipment was considered by these people to be their least helpful course (only 3 persons out of the 26); and other courses, mentioned by 2 persons each, were calculating machines, typing, office procedures, business English, and introduction to business. The managers felt that these employees should have some background in records management and introduction to business.

Promotion, Supervision, Overtime, and Salaries

The tape librarian's chance for advancement is relatively low; 48 per cent of the managers indicated these employees have a low probability to little or no chance for promotion. A few managers said that they could be promoted to computer operator or to programmer, provided they had sufficient interest and aptitude.

Tape librarians work under supervision as needed daily. About one-half of the firms reported that their tape librarians work no overtime with about one-fourth of them indicating that tape librarians might work overtime up to 3 hours weekly.

The median monthly salary for tape librarians was $425 (Table 7-2).

Table 7-2. Salaries Paid Tape Librarians According to Levels of Education

Salary	Less than High School	High School	Post High School	Degree	Total
$200-299		7			7
$300-399		2	1		3
$400-499	1	9	2		12
$500-599		1	2		3
$600-699		1			1
Totals	1	20	5	0	26

Seven of the 26 people received less than $330 per month and none received over $700 per month.

Apparently, education has less influence on salary than does experience in data processing (Tables 7-2 and 7-3). The median salary is about the same for tape librarians with different amounts of education. However, for those with less than one year of experience, the median is considerably below the entire group. For those with less than one year of experience in data processing jobs, the median salary is about $333 a month, $450 for those with three to five years of experience. Those with ten years or more of experience have a median salary of about $450 a month.

Table 7-3. Salaries Paid Tape Librarians According to Amount of Data Processing Experience

Salary	Under 1 Year	1 - 3 Years	3 - 5 Years	5 - 9 Years	10 Years or More	Total
$200-299	6	1				7
$300-399	1	1		1		3
$400-499	1	1	5	3	2	12
$500-599				2	1	3
$600-699					1	1
Totals	8	3	5	6	4	26

DATA PROCESSING TRAINING

Generally speaking, tape librarians had had some training prior to entering the data processing field, although management seemed to provide considerable on-the-job training for these people to supplement their school training.

Training Prior to Entering the Data Processing Field

Executives who responded regarding the type of data processing training for tape librarians prior to their entering employment indicated that such training might best be secured at school for data processing theory, typing, and introduction to computer theory and logic.

The employees themselves indicated that prior to taking a job in the data processing field, their main source of training (27 per cent) was in private business schools, where they learned the skill of operation of unit record equipment (Table 7-4). Those who indicated having had data processing courses in high school named data processing concepts as the major area studied. Tape librarians under the age of 21 received such training in high school classes to a greater extent than did older employees.

Table 7-4. Training and Place of Training of Tape Librarians in Data Processing Prior to Entering the Field

Training	High School	High School Part-time	College	Special Data Processing School	Private Business School	Equipment Manufacturing	Military	Place Not Given	Total
Key punch simulator	0	0	0	0	0	0	0	0	0
Key punch machine	1	1	0	0	1	0	0	0	3
Card sorter	1	1	0	0	1	0	0	0	3
Unit records	1	5	2	0	4	0	0	0	12
Wiring boards	0	1	1	0	1	0	0	0	3
Console operation	0	0	0	0	0	0	0	0	0
Access devices	0	0	0	0	0	0	0	0	0
Data converting	0	0	0	0	0	0	0	0	0
Paper tape equipment	0	0	0	0	0	0	0	0	0
Data processing concepts	3	1	1	0	0	0	0	0	5
Programming	0	0	0	0	0	0	0	0	0
Totals	6	9	4	0	7	0	0	0	26
Per Cent	23.1	34.6	15.4	0	26.9	0	0	0	

Training After Entering Data Processing

Of the training provided by management after they entered their jobs, most of the tape librarians indicated they were trained on the job (Table 7-5). To a considerably lesser extent tape librarians were sent by their employers to the manufacturers' schools. About 40 per cent of the training in data processing listed by the operators themselves was received on the job in operating unit records equipment. Other training on the job included the operation of the key punch machine and card sorter.

Evaluation of Their Educational Preparation

In general, over 66 per cent of the tape librarians indicated that their education had adequately prepared them or had prepared them very well for their jobs. Those with some data processing background in their educational experience were more satisfied with their preparation than the others. Two of the five trained tape librarians said their preparation was inadequate.

DATA PROCESSING EXPERIENCE

Almost half of the employees had been with their companies over five years (Table 7-6). Apparently all of the tape librarians had received all their data processing experience in their present companies, since all but four of them had been with their present company longer than they had been in data processing.

Tape librarians who had had other types of experience in business offices indicated they had work in sales and service occupations (54 per cent), accounting (23 per cent), and clerical (19 per cent).

CHARACTERISTICS OF THE TAPE LIBRARIAN

Tape librarians were characterized by data processing managers as being people who like detail work and who were thorough in the performance of their duties, who are perfectionistic, and who are emotionally stable and can work well under pressure.

The leisure time interests of these people include participating in sports, reading, and arts and crafts. All of them enjoy puzzles or think they are "O.K."

Table 7-5. Training and Place of Training of Tape Librarians in Data Processing After Entering the Field

Training	Company's Classes	Manufacturer's School	Manufacturer's Representative	Local School	On-the-Job	Sent to Local School	Other	Total
Key punch simulator	1	0	0	0	2	1	0	4
Key punch machine	1	3	2	0	13	2	0	21
Card sorter	0	3	0	0	12	2	0	17
Unit record	3	14	2	0	30	6	0	55
Wiring boards	0	4	0	2	1	0	0	7
Summary punch	0	2	0	0	2	0	0	4
Console operation	1	2	0	0	2	0	0	5
Access devices	0	0	0	0	2	0	0	2
Converting equipment	0	1	0	0	2	0	0	3
Paper tape equipment	0	0	0	0	2	0	0	2
Data processing concepts	0	0	0	0	0	2	0	2
Programming	1	0	0	1	0	0	1	3
Data processing applications	0	1	0	1	1	3	0	6
Accounting	0	0	0	0	2	1	0	3
Management	0	0	0	0	4	0	0	4
Other business courses	0	0	0	0	0	0	0	0
Totals	7	30	4	4	75	17	1	138
Per Cent	5.1	21.7	2.9	2.9	54.3	12.3	.7	

Table 7-6. Amount of Work Experience Reported by Tape Librarians

Amount of Experience	In Data Processing	Total with Present Company
Up to 1 year	8	8
1 - 3 years	3	2
3 - 5 years	5	2
5 - 9 years	6	8
10 or more years	4	6
Totals	26	26

ATTITUDES TOWARD DATA PROCESSING AND THEIR JOBS

All of the tape librarians enjoy their work in the data processing field and plan to stay with their jobs; there was no difference whether or not they had data processing training before going on the job.

Tape librarians liked the variety of their jobs; they felt the work experiences they had were valuable and varied; they found their jobs interesting; and they enjoyed the working conditions. They found dissatisfaction with the job in that there were too many rush jobs, a likely characteristic of the job to dislike because of the perfectionist nature of these people.

SUMMARY

JOB: Tape Librarian

Duties:

1. Operate Data Processing Machines
   a. Key Punch
   b. Sorter
   c. Typewriter
   d. Interpreter

2. Handle Clerical Tasks
   a. File Register Tape
   b. Verify Punched Cards

3. Confer Regarding Computer

Supervision Required:

Only as Needed

Education:

Minimum: High School

Desired: High School

General Courses (High School):
1. General Math
2. Advanced Math
3. English

Business Courses (High School):
1. Typing
2. Introduction to Business

General Courses (Post High School):
Sample too small to be meaningful

Business Courses (Post High School):
Sample too small to be meaningful

Management Recommendations:
1. Oral and Written Communications
2. Algebra
3. Social Science

Experience:

Minimum: 3 Months or Less

Desired: 6 Months to 1 Year

Personal Characteristics:

1. 65% are women.
2. Jobs attained through promotion, advertising, and friends of the employee.
3. Tape librarians should like detail work, should be a perfectionist, and should be accurate and orderly.
4. The tape librarian enjoys her work and desires to remain in it.
5. Tape librarians feel education is adequate; majority indicated no data processing training prior to present job.
6. The tape librarian likes best the variety of the job; she likes least rush jobs.
7. Hobbies are reading, participation in sports, some arts and crafts. Puzzles are "okay" or enjoyed.
8. The median age is 28 years.

Promotional Probabilities: Low to Average

Promoted to Computer Operators or Programmers.

Education has some effect on promotion.

Salary:

Median: $425

CHAPTER VIII

UNIT RECORD EQUIPMENT OPERATOR*

About two-thirds of the unit record operators in the businesses contacted in this study were men whose jobs had been secured principally through the facilities of private employment agencies and by answering help wanted ads.

CHARACTERISTICS OF THE JOB OF THE UNIT RECORD EQUIPMENT OPERATOR

The unit record equipment operator, commonly referred to as the tab operator, generally is responsible for the operation of the accounting machine which automatically performs the data processing operations of calculating and printing. The operator of the record equipment operates several other kinds of machines and wires boards for programming a particular operation. Over three-fourths of these employees operate the sorter, the reproducer, and the interpreter, with 63 per cent operating the collator, in addition to operating the accounting machine. Over three-fifths of the unit record equipment operators punch cards, and wire collator and reproducer boards; and over 40 per cent of them wire interpreter and accounting machine boards.

Amount of Work Experience Prior to Employment

Although unit record equipment operators can get jobs with less than six months of previous experience in data processing, 33 per cent of the managers would prefer that they have from six to twelve months of such experience (Table 8-1). About 35 per cent said that at least six months of experience is a minimum requirement for getting a job in their firms, and 3 per cent of them require applicants to have worked in data processing for more than two years before they would be considered for a job in their data processing department.

Educational Requirements

Data processing managers indicated that a high school education was sufficient for unit record operators; and since almost all (94 per cent) of them had completed at least this amount of education, they are meeting the minimum amount of education acceptable by the managers.

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*The job description of the unit record equipment operator is based on the data collected in this study and previously displayed and analyzed in earlier chapters of this report.

Table 8-1. Amount of Data Processing Experience Prior to Employment as a Unit Record Equipment Operator
(% of managers indicating stated amount)

Months	Minimum Acceptable	Amount Preferred
0 - 6	65.1	29.4
7 - 12	16.7	33.1
13 - 24	4.9	26.9
25 - 36	2.0	4.9
37+	1.2	5.7

However, 55 per cent of the managers said they would prefer more than a high school education for their unit record operators, and 44 per cent of the operators had completed some education beyond high school.

General education. When managers were asked to list general areas of study that they felt would be beneficial for unit record operators, they listed communications as being of prime importance, both oral and written, along with algebra. They also listed logic and social science as good background for these employees.

The employees themselves were asked to list general high school courses that they considered helpful in their work, and they were in agreement on the importance of such courses as general mathematics, English, and social science. Mathematics and English were areas in which such employees felt they could profit by more training.

Tab operators with some post high school training felt they should have about the same background courses as in high school, particularly mathematics and English, and also they indicated a need for more social science.

Business courses. Among high school business courses of most value to them in their jobs, 68 unit record equipment operators named typing and 69 said bookkeeping. These two courses ranked highest by a great margin, although some responses indicated that business mathematics and introduction to business were helpful courses.

Shorthand was listed most frequently as the least helpful course; and nearly the same number (65) indicated that typing was the least helpful course as listed it as the most helpful course. Introduction to business was considered of little help by 13 of the unit record operators. Regarding business skills, the people with some post high school training pointed out a need for knowledge of data processing equipment, and to a certain extent, calculating machines and typing; some listed accounting principles and intermediate accounting and business mathematics as desirable business background. At this level, also, shorthand was considered by these people to be their least helpful course.

Management responses regarding high school business courses these employees should study indicated unit record equipment, wiring boards, key punch, and data processing theory to be most important (about 70 per cent). Slightly over half this number of the managers felt that these employees should also have some background in flow charting, data processing applications, typing, calculating machines, introduction to computer theory and logic, and computer console operation. More generally speaking, however, management would like to hire unit record operators with training in principles of accounting, introduction to business, introduction to systems, and records management in addition to the data processing courses.

Promotion, Supervision, Overtime, and Salaries

The unit record equipment operator's chance for advancement is average to high; 75 per cent of the managers indicated these employees have an average to high probability for promotion. They tend to be promoted to the position of computer operator or programmer.

Tab operators are supervised quite closely, with supervision provided several times a day. Over 65 per cent of the firms reported that their unit record operators average up to 3 hours of overtime a week, and about 40 per cent of them indicated that unit record operators worked from 4 to 12 hours a week overtime.

About 40 per cent of the unit record equipment operators had been with their companies for over five years and about 20 per cent of them had been in the firm over 10 years. On the other hand, over one-fourth of the tab operators had been employed by their firm for less than a year.

The median monthly salary for unit record operators was $428 (Table 8-2). Out of 374 unit record operators in the study, one-sixth reported salaries under $200 a month, and 8 per cent reported salaries of over $600 a month.

Apparently education has less influence on salary than does experience in data processing (Tables 8-2 and 8-3). The median salary is about the same for unit record operators with different amounts of education (a range of from $416 to $436 per month). However, for those with less than three years of experience and for those with more than five years, the medians are below and above the median for the entire group. For those with less than one year of experience in data processing jobs, the median salary is $333 a month. Those with 10 years of data

processing experience are paid about $499 a month ($70 above the median). Also, the male tab operators have a median salary about $90 a month more than women accounting machine operators.

Table 8-2. Salaries Paid Tab Operators According to Levels of Education

Salary	Less than High School	High School	Post High School	Degree	Total
Under $200	2	3	1	2	8
$200-299	4	33	14	1	52
$300-399	8	49	36	1	94
$400-499	8	50	58	2	118
$500-599	1	37	28	3	69
$600-699		9	11	2	22
$700-799		4	3		7
$800-899				1	1
$900-999					
$1000+		1	2		3
Totals	23	186	153	12	374

Table 8-3. Salaries Paid Tab Operators According to Amount of Data Processing Experience

Salary	Under 1 Year	1 - 3 Years	3 - 5 Years	5 - 9 Years	10 years or More	Total
Under $200	6	2				8
$200-299	22	16	7	3	4	52
$300-399	27	19	14	20	14	94
$400-499	14	32	22	28	22	118
$500-599	4	5	6	29	25	69
$600-699		1	2	8	11	22
$700-799				2	5	7
$800-899					1	1
$900-999						
$1000+				3		3
Totals	73	75	51	93	82	374

DATA PROCESSING TRAINING

Generally speaking unit record equipment operators had had some training prior to entering the data processing field, although management seemed to provide considerable on-the-job training for these people.

Training Prior to Entering the Data Processing Field

Executives who responded regarding the type of data processing training for unit record equipment operators prior to their entering employment, indicated that such training might best be secured at school in unit record equipment, wiring boards, data processing concepts, key punch, flow charting and data processing applications.

The employees themselves indicated that prior to taking a job in the data processing field, their main source of training was the special data processing school, where they learned such skills as operation of unit record equipment, data processing concepts, and wiring boards (Table 8-4). Most of the training in operating equipment (61 per cent) was received in special data processing schools and in equipment manufacturers' classes. Those who indicated having had data processing courses in high school named data processing concepts (11 per cent) as the major area studied.

Tab operators under the age of 21 received their training in both special data processing schools and private business schools, whereas the older employees received their training more often only in the data processing schools. As the age of unit record operators rises, the proportion of them who have received training in a manufacturer's school prior to entering data processing work also rises.

Training After Entering Data Processing

Of the training provided by management after they entered their jobs, most of the unit record equipment operators indicated they were trained directly on the job (Table 8-5). To a considerably lesser extent, unit record operators were sent by their employers to the manufacturers' schools. Over 70 per cent of the training in data processing listed by the operators themselves was received on the job, not only in accounting machine operation, but also in operating the card sorter, key punch and summary punch, as well as in wiring boards.

Evaluation of Their Educational Preparation

In general, over 65 per cent of the tab operators indicated that their education had adequately prepared them for their jobs or had prepared them very well. Relatively little difference of opinion about adequacy of their education was found between those with data processing background in their education and those without (70 per cent versus 60 per cent).

Table 8-4. Training and Place of Training of Unit Record Equipment Operators in Data Processing Prior to Entering the Field

Training	High School	High School Part-time	College	Special Data Processing School	Private Business School	Equipment Manufacturing	Military	Place Not Given	Total
Key punch simulator	1	0	2	5	5	5	2	0	20
Key punch machine	3	2	6	54	37	34	21	6	163
Card sorter	2	4	11	67	28	24	21	1	158
Unit records	13	9	40	281	96	107	85	10	641
Wiring boards	1	3	15	67	18	22	17	1	144
Console operation	1	2	5	16	8	9	5	1	47
Access devices	0	1	3	6	2	4	2	1	19
Data converting	3	0	1	4	2	3	2	0	15
Paper tape equipment	0	0	0	10	3	2	5	0	20
Data processing concepts	31	3	29	102	41	48	23	0	277
Programming	0	0	7	31	13	17	4	0	72
Totals	55	24	119	643	253	275	187	20	1,574
Per Cent	3.5	1.5	7.6	40.9	16.1	17.5	11.9	1.3	

Table 8-5. Training and Place of Training of Unit Record Equipment Operators in Data Processing After Entering the Field

Training	Company's Classes	Manufacturer's School	Manufacturer's Representative	Local School	On-the-Job	Sent to Local School	Other	Total
Key punch simulator	0	3	0	4	11	2	0	20
Key punch machine	4	24	0	6	151	1	10	196
Card sorter	5	18	4	14	205	0	11	257
Unit record	23	140	15	52	800	5	49	1,084
Wiring boards	3	38	5	7	149	2	12	216
Summary punch	5	24	0	5	118	1	6	159
Console operation	3	18	4	3	61	1	2	92
Access devices	4	7	0	3	14	2	1	31
Converting equipment	4	3	0	3	21	0	1	32
Paper tape equipment	3	3	1	1	24	0	1	33
Data processing concepts	21	56	24	43	36	4	13	197
Programming	3	26	7	15	6	3	3	63
Data processing applications	3	11	0	9	23	0	3	49
Accounting	0	1	0	13	20	6	1	41
Management	3	1	3	15	18	0	1	41
Other business courses	2	0	2	12	7	2	1	26
Totals	86	373	65	205	1,664	29	115	2,537
Per Cent	3.4	14.7	2.6	8.1	65.5	1.1	4.5	

DATA PROCESSING EXPERIENCE

Most of the equipment operators who had been with their companies less than three years apparently had received all their data processing experience in their present company, since 179 of the unit record operators had been with their companies up to three years and only 147 of them had had as much as three years of experience in data processing jobs (Table 8-6). Over half of the accounting machine operators indicated that their only data processing experience was in unit records operations; about 19 per cent of them had worked as key punch operators, but about 16 per cent had worked as computer operators.

Table 8-6. Amount of Work Experience Reported by Unit Record Equipment Operators

Amount of Experience	In Data Processing	Total with Present Company
Up to 1 Year	72	97
1 - 3 Years	75	82
3 - 5 Years	51	44
5 - 9 Years	94	77
10 or More Years	81	72
Totals	373	372

Unit record equipment operators who had had other types of experience in business offices indicated they had worked in sales and service occupations (27 per cent), as office machines operators (21 per cent), and in the trades (11 per cent). About 8 per cent of the unit record operators had also done factory work.

CHARACTERISTICS OF THE UNIT RECORD EQUIPMENT OPERATORS

Unit record operators were characterized by data processing managers as being people who are mechanically inclined, who are relatively emotionally stable and can work under pressure; they are logical thinkers and perfectionists in the performance of their jobs.

The leisure time interests of these people are quite varied, with the greater number of them indicating interest in participating in sports, reading, household activities (refinishing furniture, upholstery, interior decorating), and arts and crafts. They enjoy puzzles, with over 97 per cent saying they think puzzles are "O.K." or enjoy them.

ATTITUDES TOWARD DATA PROCESSING AND THEIR JOBS

Generally speaking, tab operators enjoy working in the data processing field and plan to remain in it, with nearly 90 per cent of them expressing their satisfaction with the field (Table 8-7). Apparently data processing training does not influence their attitudes toward enjoyment of the field, since about the same percentage of those with training as those without indicated they enjoyed working in the field and planned to stay in it.

Table 8-7. Attitude of the Unit Record Equipment Operator Toward Data Processing Work

Training	Enjoy-Will Remain		Enjoy-Desire Change		Dislike-Will Remain		Dislike-Desire Change		Total
	N	%	N	%	N	%	N	%	
Without Training	169	89.4	18	9.5	2	1.1	0	0.0	174
With Training	158	90.8	14	8.0	2	1.1	0	0.0	189
Totals	327	90.1	32	8.8	4	1.2	0	0.0	363

Unit record equipment operators seem to like their jobs because of the kind of work involved and because of the variety they find in it. To a lesser extent they say the work is interesting and they like the working conditions. However, although these employees expressed fewer dissatisfactions than satisfactions with the job, the greater number of dissatisfactions stemmed from the "type of job" they are in. Having to do rush jobs was another source of dissatisfaction and they expressed some annoyance with the paper work involved in performing their jobs. About 10 per cent of them said they disliked nothing about their jobs.

SUMMARY

JOB: Unit Record Equipment Operator

Duties:

1. Operate Data Processing Machines
2. a. Sorter
   b. Reproducer
   c. Interpreter
   d. Collator
   e. Accounting Machine

2. Wire Boards
   a. Collator Board
   b. Reproducer Board
   c. Interpreter Board
   d. Accounting Machine Board

Supervision Required:

Several Times Daily

Education:

Minimum: High School

Desired: High School

General Courses:

1. General Math
2. Advanced Math
3. English
4. Social Science
5. Oral and Written Communications
6. Algebra

Business Courses (High School):

1. Typing
2. Business Math
3. Introduction to Business
4. First Year Accounting
5. Introduction to Systems

(Shorthand noted as least helpful; also, typing, introduction to business)

Business Courses (Post High School):
1. Data Processing Equipment
2. Accounting Principles
3. Intermediate Accounting
4. Business Math

(Typing and Business English least helpful; also, introduction to business and income tax accounting)

Management Recommendations:
1. Unit Record Equipment
2. Wiring Boards
3. Data Processing Concepts
4. Key Punch

Experience:

Minimum: 3 Months or Less

Desired: 6 - 12 Months

Personal Characteristics:

1. Over 63% are men; about 36% are women.
2. Jobs attained through promotions, private employment agencies, ads, and schools.
3. Tab Operator showed inclination to operate machines and emotional stability.
4. Most enjoy their work and desire to remain in it.
5. Tab Operators feel their education is adequate.
6. Hobbies are hunting, fishing, household activities, and sports, both participation and spectator. Puzzles are "okay" and enjoyed.
7. The median age is 28 years.

Promotional Probabilities: Average to High

Promoted to Computer Operator or Programmer.

Education has some effect on promotion.

Business Courses (Post High School):

1. Data Processing Equipment
2. Accounting Principles
3. Intermediate Accounting
4. Business Math

(Typing and Business English least helpful; also, introduction to business and income tax accounting)

Management Recommendations:

1. Unit Record Equipment
2. Wiring Boards
3. Data Processing Concepts
4. Key Punch

Experience:

Minimum: 3 Months or Less

Desired: 6 - 12 Months

Personal Characteristics:

1. Over 63% are men; about 36% are women.

2. Jobs attained through promotions, private employment agencies, ads, and schools.

3. Tab Operator showed inclination to operate machines and emotional stability.

4. Most enjoy their work and desire to remain in it.

5. Tab Operators feel their education is adequate.

6. Hobbies are hunting, fishing, household activities, and sports, both participation and spectator. Puzzles are "okay" and enjoyed.

7. The median age is 28 years.

Promotional Probabilities: Average to High

Promoted to Computer Operator or Programmer.

Education has some effect on promotion.

Monthly Salary:

Median:	$413 (without computers) 433 (with computers)
Men:	Average approximately $90 more per month than women; women show more time with company.
High School:	$380
College:	$450
10+ Years:	$520
Top Salary:	$1000

CHAPTER IX

COMPUTER OPERATOR*

Over four-fifths of the computer operators in the businesses contacted in this study were men whose jobs had been secured principally through promotion.

CHARACTERISTICS OF THE JOB OF THE COMPUTER CONSOLE OPERATOR

The computer console operator generally is responsible for the operation of the computer. The operator of the computer operates several other kinds of machines and wires boards for programming. Over half of these employees operate the high speed printer, sorter, interpreter, reproducer and collator in addition to punching cards. About half of these employees wire the collator and reproducer boards.

Amount of Work Experience Prior to Employment

Although computer operators can get jobs with less than six months of previous experience in data processing, nearly 70 per cent of the managers would prefer that they have more than six months of experience, with 65 per cent of them preferring from six months to two years of such experience (Table 9-1). Over 65 per cent of the

Table 9-1. Amount of Data Processing Experience Prior to Employment As a Computer Operator

Months	Minimum Acceptable	Amount Preferred
0 - 6	65.4	29.4
7 - 12	16.7	35.8
13 - 24	9.3	30.0
25 - 36	1.2	8.1
37+	0.8	5.3

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*The job description of the computer console operator is based on the data collected in this study and previously displayed and analyzed in earlier chapters of this report.

managers said that up to six months of experience is a minimum requirement for getting a job in their firms. Over 11 per cent of them require applicants to have worked in data processing for more than one year before they would be considered for a job in their data processing departments.

Educational Requirements

Data processing managers indicated that a high school education was sufficient for computer console operators, and since almost all (97 per cent) of them had completed at least this amount of education, they are meeting the minimum amount of education acceptable by the managers. However, two-thirds of the managers said they prefer more than a high school education for their computer console operators, and 44 per cent of the operators had completed some education beyond high school.

General education. When managers were asked to list general areas of study that they felt would be beneficial for computer console operators, they listed communications as being of prime importance, both oral and written, along with algebra. They also listed logic and psychology as good background for these employees.

The employees themselves were asked to list general high school courses that they considered helpful in their work, and they were in agreement on the importance of such courses as general and advanced mathematics, English and social science. Mathematics and English were areas in which such employees felt they could profit by more training.

Computer console operators with some post high school training felt they should have about the same background courses as in high school, particularly mathematics and English, and they also indicated a need for more social science.

Business courses. Among high school business courses of most value to them in their jobs, 57 computer console operators named bookkeeping. Although bookkeeping ranked highest, 28 operators indicated that business mathematics and 23 operators indicated that typing were helpful business courses on their jobs.

Typing and shorthand were listed most frequently as the least helpful courses for the performance of the job of computer console operator. Regarding business skills, the people with some post high school training pointed out a need for knowledge of data processing equipment, and to a certain extent, calculating machines and typing; principles of accounting was listed as desirable business background. At this level report writing, shorthand and typing were considered by these people to be their least helpful courses.

Management responses regarding high school business courses these employees should study indicated data processing theory, computer console operation, introduction to computer theory and logic, and unit record equipment. Other courses managers would like for their computer console operators to study in high school are data processing applications, programming, flow charting, wiring boards and key punch. In addition to the data processing courses, management would like to hire these operators with training in introduction to business, introduction to systems, and first year accounting.

Promotion, Supervision, Overtime, and Salaries

The computer console operator's chance for advancement is average to high; 79 per cent of the managers indicated these employees have an average to high probability for promotion. They tend to be promoted to the position of programmer or supervisor.

Computer console operators need to be supervised about once a day. About 42 per cent of the firms reported that their computer console operators work overtime from 1 to 11 hours per week with most of the overtime in the 4-7 hours per week category.

The median monthly salary for computer console operators was $478 (Table 9-2). Out of 275 computer console operators in the study, only 3 people reported salaries under $200 a month, and only 2 people reported salaries over $800 a month.

About 40 per cent of the computer console operators had been with their companies for over five years, and about 20% of them had been in the firm over 10 years. On the other hand, 26 per cent of the computer operators had been employed by the firm for less than a year.

Apparently education has less influence on salary than does experience in data processing (Tables 9-2 and 9-3). The median salary is about the same for computer console operators with different amounts of education (a range of from $436 to $454 per month). However, for those with less than five years of experience and for those with more than five years, the medians are below and above the median for the whole group. For those with less than one year of experience in data processing jobs, the median salary is $374 a month. Those with ten years of data processing experience are paid about $568 a month ($90 above the median).

Table 9-2. Salaries Paid Computer Console Operators According to Levels of Education

Salary	Less than High School	High School	Post High School	Degree	Total
Under $200	1	2			3
$200-299		9	3		12
$300-399		15	31	2	48
$400-499	2	41	51	1	95
$500-599	4	36	38	1	79
$600-699		13	16	1	30
$700-799		3	2	1	6
$800-899					0
$900-999					0
$1,000+			2		2
Totals	7	119	143	6	275

DATA PROCESSING EDUCATION OF COMPUTER CONSOLE OPERATORS

Generally speaking, computer console operators had had some training prior to entering the data processing field, although management seemed to provide considerable on-the-job training for these people.

Training Prior to Entering the Data Processing Field

Executives who responded regarding the type of data processing training for computer console operators prior to their entering employment, indicated that such training might best be secured in school for data processing concepts, computer console operation, introduction to computer theory and logic, unit record equipment, data processing applications, programming, flow charting, and wiring boards.

Table 9-3. Salaries Paid Computer Console Operators According to Amount of Data Processing Experience

Salary	Under 1 Year	1 - 3 Years	3 - 5 Years	5 - 9 Years	10 Years or More	Total
Under $200	2			1		3
$200-299	3	6	1	2		12
$300-399	19	16	8	2	3	48
$400-499	15	21	25	25	9	95
$500-599	3	13	17	27	19	79
$600-699		2	1	13	14	30
$700-799				1	5	6
$800-899						
$900-999						
$1,000+			1	1		2
Totals	42	58	53	72	50	275

The employees themselves indicated that prior to taking jobs in the data processing field, their main source of training was the special data processing schools and the equipment manufacturers' schools where they learned such skills as operation of unit record equipment and data processing concepts (Table 9-4). Most of the training in the operation of the computer console (73 per cent) was received in special data processing schools and in equipment manufacturers' classes. Those who indicated having had data processing courses in high school or college were a small per cent of the total (7 per cent) and their major area of study was in data processing concepts.

Computer operators under the age of 21 received their training in both special data processing schools and in private business schools, whereas the older employees received their training mostly in the equipment manufacturers' schools.

Table 9-4. Training and Place of Training of Computer Console Operators in Data Processing Prior to Entering the Field

Training	High School	High School Part-time	College	Special Data Processing School	Private Business School	Equipment Manufacturing	Military	Place Not Given	Total
Key punch simulator	1	0	0	5	2	0	5	0	13
Key punch machine	1	0	6	26	16	9	19	4	81
Card sorter	1	1	4	31	28	14	18	4	101
Unit records	4	4	17	136	128	81	75	21	466
Wiring boards	0	2	4	30	29	19	13	3	100
Console operation	0	1	2	17	9	39	6	3	77
Access devices	0	0	1	11	4	13	6	2	37
Data converting	0	0	1	6	3	10	6	0	26
Paper tape equipment	0	0	0	6	2	8	6	1	23
Data processing concepts	6	2	30	77	43	88	36	3	285
Programming	1	0	4	19	9	29	4	3	69
Totals	14	10	69	364	273	310	194	44	1,278
Per Cent	1.1	0.8	5.4	28.5	21.4	24.2	15.2	3.4	

Training After Entering Data Processing

Of the training provided by management after they entered their jobs, most of the computer console operators indicated they were trained directly on the job (Table 9-5). To a considerably lesser extent, computer operators were sent by their employers to the manufacturers' schools. Over half of the training in data processing listed by the operators themselves was received on the job, principally the operation of unit record equipment, computer console operation, and operation of the card sorter and key punch machine.

Evaluation of Their Educational Preparation

In general, about two-thirds of the computer console operators indicated that their education had adequately prepared them for their jobs or had prepared them very well. There was no difference of opinion about the adequacy of their education between those with data processing background in their education and those without.

CHARACTERISTICS OF THE COMPUTER CONSOLE OPERATOR

Most of the computer console operators who had been with their companies one to three years apparently had received all their data processing experience in their present company, since 58 of the operators had been with their companies one to three years and 56 of them had been in data processing for one to three years (Table 9-6). About half of the computer operators who had been with the company for less than one year had had experience in data processing before coming to the company to work. Over a fourth of the computer console operators indicated that their only data processing experience was in computer console operation; about 50 per cent of them had worked as unit record equipment operators.

Computer console operators who had had other types of experience in business offices indicated they had worked in sales and service occupations (27 per cent), as clerical workers (21 per cent), and in the trades (12 per cent). About 6 per cent of the computer console operators had also done factory work.

Personal Characteristics

Computer console operators were characterized by data processing managers as being people who are emotionally stable and can work under pressure; who are able to get along with people; and who are logical thinkers.

The leisure time interests of these people are quite varied, with the greater number of them indicating interest in participating

Table 9-5. Training and Place of Training of Computer Console Operators in Data Processing After Entering the Field

Training	Company's Classes	Manufacturer's School	Manufacturer's Representative	Local School	On-the-Job	Sent to Local School	Other	Total
Key punch simulator	2	1	0	5	19	1	1	29
Key punch machine	8	16	4	6	109	2	7	152
Card sorter	7	13	3	9	138	2	4	176
Unit record	34	105	12	42	518	23	19	753
Wiring boards	6	41	4	15	70	8	5	149
Summary punch	5	22	1	7	67	6	2	110
Console operation	17	28	13	4	162	5	4	233
Access devices	2	13	2	3	71	2	4	97
Converting equipment	6	7	6	2	48	1	0	70
Paper tape equipment	3	5	5	1	49	1	3	67
Data processing concepts	26	85	41	37	61	17	40	307
Programming	8	44	9	11	15	6	7	100
Data processing applications	6	10	6	5	21	3	7	58
Accounting	1	1	0	15	9	2	5	33
Management	1	3	0	12	11	2	4	33
Other business courses	0	1	0	20	6	5	4	36
Totals	132	395	106	194	1,374	86	116	2,403
Per Cent	5.5	16.4	4.4	8.1	57.2	3.6	4.8	

Table 9-6. Amount of Work Experience Reported by Computer Console Operators

Amount of Experience	In Data Processing	Total with Present Company
Up to 1 year	81	42
1 to 3 years	56	58
3 to 5 years	40	53
5 to 9 years	56	72
10 years or more	42	50
Totals	275	275

in sports, engaging in household activities, hunting and fishing, reading, and hiking and camping. They enjoy puzzles, with over 98 per cent saying they think puzzles are "O.K." or enjoy them.

Attitudes Toward Data Processing As an Occupational Field

Generally speaking, computer console operators enjoy working in the data processing field and plan to remain in it, with 93 per cent of them expressing their satisfaction with the field (Table 9-7). Apparently data processing training does not influence their attitudes toward enjoyment of the field, since about the same percentage of those with training as without indicated they enjoyed working in the field and planned to stay in it.

Computer console operators seem to like their jobs because of the kind of work involved and because they find the work interesting. To a lesser extent they say the job has variety and they like the working conditions. The greatest number of dissatisfactions resulted from the rush jobs and irregular hours. Other sources of dissatisfaction with their jobs were the salary and the kind of work involved. About 9 per cent of them said they disliked nothing about their job.

Table 9-7. Attitude of Computer Console Operators With and Without Data Processing Training Prior to Employment

Training	Enjoy-Will Remain		Enjoy-Desire Change		Dislike-Will Remain		Dislike-Desire Change		Total
	N	%	N	%	N	%	N	%	
Without training	122	49.2	10	62.5	0		1		133
With training	126	50.8	6	37.5	1		0		133
Totals	248		16		1		1		266

SUMMARY

JOB: Computer Console Operator

Duties:

1. Operate
    a. Computer
    b. High Speed Printer
    c. Sorter
    d. Interpreter
    e. Reproducer
    f. Collator
2. Punch Cards
3. Wire
    a. Collator Board
    b. Reproducer Board
4. Test Sample Routines on Computer

Supervision Required:

Once a Day

Education:

Minimum: High School

Desired: High School with some Post High School

General Courses (High School):
1. General Mathematics
2. Advanced Mathematics
3. English
4. Social Science

Business Courses (High School):
1. Bookkeeping
2. Business Mathematics
3. Typing

Education (continued):

General Courses (Post High School):

1. General Mathematics
2. English
3. Advanced Mathematics
4. Social Science
5. Oral and Written Communications
6. Logic and Philosophy
7. Psychology

Business Courses (Post High School):

1. Data Processing Theory
2. Principles of Accounting
3. Data Processing Application
4. Introduction to Business
5. Introduction to Systems
6. First Year Accounting

Experience:

Minimum: 3 Months to 1 Year

Desired: 6 Months to 18 Months

Personal Characteristics:

1. 90% are men. Women in manufacturing and transportation are in greater proportionate numbers to total than men in same industries.

2. Jobs attained through promotions and advertising.

3. Computer operator should be able to get along with people and should have the ability to work under pressure.

4. The computer operator enjoys his work and desires to remain in it.

5. Computer operators feel their education is adequate.

6. Computer operators like the job type best; they like rush jobs least.

7. Hobbies are participation in sports and reading. They enjoy puzzles.

8. The median age is 27 years.

Promotional Probabilities: Average to High

Promoted to Programmer, Supervisor

Education has some effect on promotion.

Salary:

Median:	$478
Large Installations	560
Medium or Small	462
Men:	$496
Women:	412
High School:	$482
Post High School-Degree	500

CHAPTER X

THE PROGRAMMER

Programmers are, as a rule, men (89 per cent), who obtained their jobs primarily through promotions, although the private employment agency accounted for almost as many such jobs as did advertising. Schools as a job source for programmers ranked third.

CHARACTERISTICS OF THE JOB OF THE PROGRAMMER

Primarily, the duties performed by a programmer in his job are preparing programs, making flow charts, debugging programs, coding for programming, making block diagrams, and analyzing data flow. The programmer also analyzes systems, operates the computer, makes test sample routine, and punches cards.

The programmers in this study reported that the programming language primarily used was Autocoder. Other languages used were machine language, COBOL and SPS. The use of Fortran as a programming language was not significant; only 13 such responses being received.

Work Experience Required Prior to Employment

Programmers are expected to have had data processing experience in order to qualify for their jobs (Table 10-1). About 86 per cent of the managers indicated that up to six months' experience in data processing would be the minimum experience accepted for employment as a programmer. Over half of them said that at least seven months or more experience in data processing would be preferred for employment as a programmer.

Educational Requirements

About one-third of the programmers hold at least a bachelor's degree. Nearly 90 per cent have had some education beyond high school but have not completed work for a degree. This educational level held by the programmers, however, does not meet the standards preferred by the data processing managers, of whom 61 per cent felt that people in this job should have at least a bachelor's degree.

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*The job description of the programmer is based on the data collected in this study and previously displayed and analyzed in earlier chapters in this report.

Table 10-1. Amount of Data Processing Experience Prior to Employment as a Programmer
(% of Managers Indicating Stated Amount)

Months	Minimum Acceptable	Amount Preferred
0 - 6	86.0	42.2
7 - 12	7.8	32.8
13 - 24	4.7	20.4
25 - 36	1.6	4.7

However, the education completed by programmers does meet the minimum standards acceptable to the data processing managers, in that only 9 per cent feel that a college degree is the minimum amount of education for people in this job, and another 34 per cent say they will consider someone for the job of programmer if he has some education beyond high school but not necessarily a degree.

General education. Programmers felt that general mathematics was the most valuable general education course they had studied in school, and they felt generally that they should have had more work in advanced mathematics. English, too, ranked high on the list of helpful courses, next to mathematics. This agrees with what management feels to be the most beneficial of the general education courses, although they emphasize the need for good written and oral communications. These courses ranked the same in importance at both high school and post high school levels.

Business courses. Of the business courses considered to be helpful in their jobs, programmers mentioned business mathematics at the high school level most frequently along with bookkeeping in the high school and accounting at the post high school level. Of the courses they had had in college, these people found courses in data processing equipment the most helpful. Statistics and data processing applications were mentioned by quite a number of these employees as being useful courses for their kind of work.

Management, however, felt that programmers should study more management courses, including introduction to systems, principles of management and records management. They felt, too, that a second year of accounting, introduction to business and statistics would be desirable preparation in business for these people.

Promotion, Overtime, Supervision, and Salaries

The programmer has a high to average probability of being promoted, according to the managers of data processing departments in which they work. Over 32 per cent of the managers said that education has a definite bearing on promotability of the programmer, while about the same number say that education has "quite a bit" of influence on promotions of these people.

The programmer is likely to be promoted to a systems analyst position, to some higher level supervisory job, or to a data processing manager position.

Most programmers are required to work overtime. Only 15 per cent of the managers said that their programmers worked regular business hours. Most of them (43 per cent), however, said these employees in their departments work up to seven hours a week overtime, but about 10 per cent said that their employees work more than 12 hours weekly outside of regular hours.

Programmers work more or less independently and require little supervision, or, according to the data processing managers, "only as needed."

The median salary for programmers is $627 a month (Table 10-2). The median salary paid programmers who hold a college degree is somewhat higher than the general median ($647); and those without a degree but with some work beyond high school have a median salary of $607.

The amount of experience in data processing affects the salary of programmers more than does the amount of education (Table 10-3). The median salary for those programmers who have worked in data processing for less than one year is about $100 a month less ($526) than the median salary, and those with over ten years of experience in the field have a median salary of $745 a month.

Table 10-2. Salaries Paid Programmers According to Levels of Education

Salary	Less than High School	High School	Post High School	Degree	Total
Under $200	0	0	1	1	2
$200-299	0	1	1	0	2
$300-399	0	0	7	2	9
$400-499	0	7	33	9	49
$500-599	2	17	36	23	78
$600-699	1	18	40	36	95
$700-799	2	10	24	10	46
$800-899	0	8	14	14	36
$900-999	0	1	2	4	7
$1,000+	0	1	3	4	8
Totals	5	63	161	103	332

Table 10-3. Salaries Paid Programmers According to Amount of Data Processing Experience

Salary	Under 1 Year	1 - 3 Years	3 - 5 Years	5 - 9 Years	10 Years or More	Total
Under $200	2	0	0	0	0	2
$200-299	1	0	1	0	0	2
$300-399	5	2	1	1	0	9
$400-499	17	13	8	9	2	49
$500-599	23	24	13	14	4	78
$600-699	11	24	28	25	7	95
$700-799	0	4	7	24	11	46
$800-899	0	1	5	23	7	36
$900-999	1	0	1	3	2	7
$1,000+	1	0	2	2	3	8
Totals	61	68	66	101	36	332

DATA PROCESSING EDUCATION

Programmers received most of the training in data processing prior to entering the data processing field in special data processing schools, colleges and in manufacturers' classes; training after entering the data processing field was again in manufacturers' classes with the largest percentage of training being accomplished on the job.

Training Prior to Entering Data Processing

Programmers for the most part had their training in data processing after starting to work in the field. However, of the training they received before entering the data processing field, 28 per cent of the courses were received in special data processing schools, especially on unit record equipment and data processing concepts (Table 10-4). A large portion of the training was received in manufacturers' classes and in college, with more of these individuals having learned data processing concepts there than anywhere else. Most of the programming was learned at a manufacturer's school, or in college, or at a special data processing school.

Training After Entering Data Processing

Following initial employment in the field of data processing, most of the programmers' training was on the job, but about a third of the training was done in manufacturers' classes (Table 10-5). Only 6 per cent of the courses were offered as classes operated by the companies themselves, and only about 2 per cent of the training was in classes in local institutions for which the company paid the fees; and about 9 per cent of the courses were taken by these employees in local education institutions and paid for by the employee himself. Most of the courses studied by these people after entering the data processing field dealt with data processing concepts, unit record equipment, and programming.

Evaluation of Their Education

The programmers felt for the most part that their educational background was adequate (about 57 per cent), with about 13 per cent of them indicating that they were very well prepared. Although almost 30 per cent felt that they had not been trained adequately for their jobs, those who had had data processing courses before going into the field were more satisfied with their education. Less than 20 per cent of those with data processing training said they had been inadequately prepared for work in the field, while 41 per cent of those without prior data processing training felt this way.

Table 10-4. Training and Place of Training of Programmers in Data Processing Prior to Entering the Field

Training	High School	High School Part-time	College	Special Data Processing School	Private Business School	Equipment Manufacturing	Military	Place Not Given	Total
Key punch simulator	0	0	1	5	2	0	1	0	9
Key punch machine	0	1	25	30	15	4	17	1	93
Card sorter	0	2	18	38	21	10	17	1	107
Unit records	0	4	60	152	84	63	77	3	443
Wiring boards	0	1	11	35	18	16	15	0	96
Console operation	0	0	20	21	4	34	6	1	86
Access devices	0	1	6	8	3	29	3	0	50
Data converting	0	0	3	5	1	9	4	0	22
Paper tape equipment	0	0	2	5	2	10	3	0	22
Data processing concepts	8	1	183	108	33	150	26	3	477
Programming	0	1	41	30	7	58	5	0	142
Totals	8	11	370	437	190	348	174	9	1,547
Per Cent	0.5	0.7	24.0	28.0	12.0	22.0	11.0	0.6	

Table 10-5. Training and Place of Training of Programmers in Data Processing After Entering the Field

Training	Company's Classes	Manufac-turer's School	Manufac-turer's Repre-sentative	Local School	On-the-Job	Sent to Local School	Other	Total
Key punch simulator	1	1	0	3	8	1	0	14
Key punch machine	7	12	1	4	114	1	14	153
Card sorter	9	20	0	7	128	0	9	173
Unit record	33	152	13	29	413	3	35	678
Wiring boards	6	51	3	8	59	2	6	135
Summary punch	4	32	3	6	60	1	4	110
Console operation	7	55	15	3	128	2	9	219
Access devices	3	74	13	1	40	0	6	137
Converting equipment	3	14	4	0	26	0	3	50
Paper tape equipment	2	9	5	0	38	0	3	57
Data processing concepts	54	315	75	71	116	32	28	691
Programming	21	190	44	9	36	6	3	309
Data processing applications	10	42	10	9	79	3	7	160
Accounting	2	1	2	46	18	3	5	77
Management	13	1	4	39	33	6	9	105
Other business courses	3	1	4	65	23	9	14	119
Totals	178	970	196	300	1,319	69	155	3,187
Per Cent	5.8	30.0	6.0	9.0	41.0	2.0	5.0	

DATA PROCESSING EXPERIENCE

About one-third of the 332 programmers had been in the data processing field from five to nine years (Table 10-6).

Table 10-6. Amount of Experience Reported by Programmers

Amount of Experience	In Data Processing	Total with Present Company
Up to 1 year	61	89
1 - 3 years	68	94
3 - 5 years	66	44
5 - 9 years	101	59
10 or more years	36	46
Totals	332	332

Those programmers with up to three years of experience in data processing apparently were promoted from other positions in the organization because they were with their present employer longer than they had been in data processing. About half of the programmers with three to nine years experience in data processing apparently were hired as programmers by their present employers, and so evidently business is able to recruit experienced data processing personnel into this position.

Their experience in data processing, however, has been mainly in the operation of unit record equipment, with over one-fourth of them reporting experience in this area. Slightly over a third of the programmers (34.5 per cent) had had experience in programming prior to this job.

Prior to entering into the field of data processing, programmers had worked in the clerical field, in sales and services occupations, in the trades occupations, and in accounting.

PERSONAL CHARACTERISTICS

According to data processing managers, programmers are logical thinkers; they get along well with people; they are emotionally stable and can work under pressure; and they are thorough and detailed in the work. In addition, programmers are dedicated to their work and willing to work overtime to complete their jobs, and they are creative persons who are willing to accept challenge.

As to leisure-time activities, the programmer enjoys sports participation and reading, with household duties, outdoor activity, and some arts and crafts being mentioned as avocations or leisure-time activity. This employee is one who enjoys puzzles or finds them "O.K."; fewer than 4 per cent hated puzzle type activities.

ATTITUDES TOWARD DATA PROCESSING AS AN OCCUPATIONAL FIELD

Perhaps reflecting the managers' characterization of the programmers as logical thinkers, and people who are emotionally stable and like detail work, the things that these people like about their job are the problem-solving aspects of it and the challenge it presents.

Programmers like data processing as a field (95 per cent of them say they enjoy it and plan to remain in it, Table 10-7). Those without data processing training before going into the field express about the same degree of satisfaction as those with prior training, perhaps because most of their training in data processing was received by these people after they had started work in the field.

Table 10-7. Attitude of the Programmer Toward Data Processing Work

Training	Enjoy-Will Remain		Enjoy-Desire Change		Dislike-Will Remain		Dislike-Desire Change		Total
	N	%	N	%	N	%	N	%	
Without training	150	49.4	8	57.0	2	67.0	0	0	160
With training	160	51.6	6	43.0	1	33.0	1	0.3	168
Totals	310	94.5	14	4.3	3	0.9	1	0.3	328

SUMMARY

JOB: Programmer

Duties:

1. Preparing Programs
2. Making Flow Charts
3. Debugging Programs
4. Coding for Programming
5. Making Block Diagrams
6. Analyzing Data Flow
7. Analyzing Systems
8. Operating the Computer
9. Making Test Sample Routines
10. Punching cards

Supervision Required:

Only as Needed

Education:

Minimum: High School
Junior College or Technical School

Desired: College Graduate

General Courses:

1. General Math
2. Advanced Math
3. English
4. Oral and Written Communication

Business Courses (Post High School):

1. Data Processing Equipment
2. Business English
3. Accounting Principles
4. Business Math and Statistics
5. Data Processing Applications
6. Introduction to Systems
7. First Year Accounting
8. Introduction to Business
9. Second Year Accounting
10. Principles of Management

Experience:

Minimum: 3 Months to 1 Year

Desired: 1 1/2 to 2 Years

Personal Characteristics:

1. 82% are men; 17.4% are women.
2. Jobs attained through promotions, private employment agencies, advertising and schools.
3. Programmer should be logical thinker and have the ability to get along with people.
4. The programmer enjoys his work and desires to remain in it; his attitude is not regulated by whether he had data processing work or not.
5. Programmers feel their education is adequate.
6. The programmer likes best the problem-solving factor of his job.
7. Hobbies are participation in sports and reading. Puzzles are enjoyed.
8. The median age is 29 years.

Promotional Probabilities: Average to High

Promoted to Chief Programmer, Systems Analyst, Supervisor, and Data Processing Manager; some are promoted to Project Director.

Education has a definite effect upon promotion.

Salary:

Median: $626
(Slight tendency for larger installations to pay higher salaries)

Men: $642
Women: 557

Trend shows programmers with total amount of 4-6 years data processing experience earn median salary of $718; those with programming experience only earn median salary of $683.

CHAPTER XI

DATA PROCESSING MANAGER

Data processing managers, generally speaking, were men (93 per cent). More of the data processing managers (40 per cent) had attained this level of job through promotions than in any other way, but about equal number (30 per cent) had obtained their positions either through the recommendations of equipment manufacturers or by answering advertisements.

CHARACTERISTICS OF THE JOB OF THE DATA PROCESSING MANAGER

The data processing manager serves mainly in a supervisory-managerial capacity. The two tasks most frequently mentioned by the data processing managers were conferring with others about computer use and scheduling computer time. The data processing manager tends to be the supervisory of computer personnel, of auxiliary equipment operators, and of the key punch and unit record equipment operators. He also confers about and schedules work in the unit record equipment section and in the key punch section.

An important area of work for the data processing manager is in systems, analyzing systems and work flow and in preparing flow charts. He operates some equipment, particularly the computer, the card sorter, and the high-speed printer.

Although programming was an important duty, most of the managers indicated that they did some programming and that they used a variety of program languages on the job, but Autocoder was used the most with some use of SPS, COBOL and machine language. Fortran was mentioned by only five of the 65 data processing managers.

Work Experience Required Prior to Employment

Data processing managers are expected to have considerable data processing experience in order to qualify for their jobs. Over 50 per cent of the executives indicated that they would prefer someone with over three years' experience. Over one-fourth of the executives preferred between one and three years of data processing experience for their data processing managers. About one-fifth of the executives indicated that they would hire data processing managers with less than one year of experience in data processing.

Educational Requirements

Evidently experience is more important for the data processing manager than is a college degree; only 16 per cent of them hold college degrees. There is an indication that some education beyond high school is important, because about 45 per cent of the data processing managers had completed some post high school education. This educational level held by the data processing managers, however, does not meet the standards preferred by the data processing managers, which is a college degree.

General education. Data processing managers felt that basic and advanced mathematics and English were the most valuable general education courses they had studied in school, and they felt generally that they should have had more work in advanced mathematics and English. This agrees with what management feels to be the most beneficial of the general education courses; they emphasized especially the need for good written and oral communications. These courses ranked the same in importance at both the high school and post high school levels.

Business courses. Of the business courses considered to be helpful in their jobs, data processing managers mentioned most frequently accounting at the post high school level and bookkeeping at the high school level, along with business mathematics at both levels. In addition, at the post high school level, data processing managers found courses in data processing equipment, intermediate accounting, and principles of management helpful to them on their jobs.

Management, however, felt that data processing managers should study more management courses, including introduction to systems, statistics, introduction to business, principles of management, intermediate accounting, and principles of finance. They felt, too, that cost accounting, records management, quantitative analysis and economics would be desirable preparation in business for these people.

Promotion, Overtime, Supervision, and Salaries

The executives who were interviewed were about evenly divided in their opinions regarding the probability of promotion for data processing managers, with 23 of them saying that these people have an average (16) or high (7) chance for promotion; and 27 of them saying that data processing managers have little or no probability of promotion.

Over half of the managers of data processing departments felt that the amount of education had a bearing on whether or not a data processing manager would be promoted and another 10 per cent said that education affected promotability "quite a bit." However, a fifth of the executives felt that education was of little importance in determining promotion of data processing managers. The only promotion open to data processing managers is to some other supervisory position.

Most data processing managers are required to work overtime. Only 12 per cent of the managers said that their data processing manager worked only regular business hours. Most of them (40 per cent), however, said these employees in their departments work over 8 hours a week overtime. Data processing managers work more or less independently as supervisors and require little supervision of themselves.

The median salary for data processing managers is $741 a month (Table 11-1). However, the median salary paid data processing managers who hold a college degree is considerably higher than the general median ($850); and those without a degree but with some work beyond high school have a median salary of $740, and those with just a high school education have a median salary of $687.

Table 11-1. Salaries Paid Data Processing Managers According to Levels of Education

Salary	Less than High School	High School	Post High School	Degree	Total
$400-499	0	2	1		3
$500-599	1	15	11	3	30
$600-699	0	15	18	1	34
$700-799	2	12	14	6	34
$800-899		10	10	6	26
$900-999		3	9	1	13
$1,000+	1	3	9	9	22
Totals	4	60	72	26	162

The median salary is $818 for those data processing managers who have had ten years or more experience in data processing (Table 11-2). For those people who have had less than ten years experience, the median salaries are all lower than the $741 median for the total data processing managers.

Table 11-2. Salaries Paid Data Processing Managers According to Amount of Data Processing Experience

Salary	Under 1 Year	1 - 3 Years	3 - 5 Years	5 - 9 Years	10 Years or More	Total
$400-499			2	1		3
$500-599	1	4	4	16	5	30
$600-699	1	4	3	15	11	34
$700-799	1	2	4	9	18	34
$800-899			3	6	17	26
$900-999		1		2	10	13
$1,000+		2	3	5	12	22
Totals	3	13	19	54	73	162

DATA PROCESSING EDUCATION

Data processing managers have received most of their training in data processing in manufacturers' classes, both before and after they began working in the field. A few of these men received some data processing training in the military service and in special data processing schools.

Training Prior to Entering Data Processing

Data processing managers for the most part had their training in data processing after starting to work in the field. However, of the training they received before entering the data processing field half of the courses were received in manufacturers' classes, especially on unit record equipment and data processing concepts (Table 11-3).

Table 11-3. Training and Place of Training of Data Processing Managers in Data Processing Prior to Entering the Field

Training	High School	High School Part-time	College	Special Data Processing School	Private Business School	Equipment Manufacturing	Military	Place Not Given	Totals
Key punch simulator	0	0	0	0	0	2	2	0	4
Key punch machine	0	1	3	5	4	15	9	0	37
Card sorter	0	0	2	13	6	24	11	0	56
Unit records	0	0	10	55	26	119	49	0	259
Wiring boards	0	0	2	12	5	28	11	0	58
Computer operation	0	0	1	6	0	22	2	0	31
Access devices	0	0	0	3	0	9	2	0	14
Data converting	0	0	0	2	0	9	1	0	12
Paper tape equipment	0	0	0	0	0	7	2	0	9
Data processing concepts	3	0	28	21	12	73	11	1	149
Programming	0	0	4	4	1	31	0	0	40
Totals Per Cent	3 0.4	1 0.2	50 7.5	121 18.1	54 8.1	339 50.6	100 14.9	1 0.1	669

The greater portion of their training was received, however, on the job and in manufacturers' classes where they learned the operation of unit record equipment and data processing concepts. Most of the programming was learned by the data processing managers in manufacturers' classes.

Training After Entering Data Processing

Following initial employment in the field of data processing, most of the data processing managers' training was on the job (38.8 per cent) or in manufacturers' classes (34.7 per cent) (Table 11-4). Most of the courses studied by these people after entering the data processing field dealt with the operation of unit record equipment, data processing concepts, use of console devices, programming, and management training.

Evaluation of Their Education

The data processing managers felt for the most part that their educational background was adequate (about 56 per cent), with about 9 per cent of them indicating that they were very well prepared. Although over a third of the people felt that they had not been trained adequately for their jobs, those who had had data processing courses before going into the field were more satisfied with their education. About a third of those with data processing training said they had been inadequately prepared for work in the field, while two-thirds of those without prior data processing training felt this way.

DATA PROCESSING EXPERIENCE

Of the data processing employees who have been with their companies up to five years (67 of them), all of them went into the data processing field after starting to work with their present companies (Table 11-5). About one-fourth of the people who have been in data processing more than five years came to their present companies with data processing experience. Over half of the data processing managers have worked for their companies over five years, which would be an indication that this position is one that people are moved into after a period of work experience. Their experience in data processing, however, has been mainly in the operation of unit record equipment. About one-fourth of the data processing managers had had experience in supervision prior to this job.

Prior to entering into the field of data processing, data processing managers had worked in sales and services occupations, in clerical positions and in the trades.

Table 11-4. Training and Place of Training of Data Processing Managers in Data Processing After Entering the Field

Training	Company's Classes	Manufacturer's School	Manufacturer's Representative	Local School	On-the-Job	Sent to Local School	Other	Total
Key punch simulator	1	2	1	0	8	0	1	13
Key punch machine	5	11	4	0	62	0	7	89
Card sorter	5	23	5	0	62	0	4	99
Unit record	28	160	22	6	254	5	10	485
Wiring boards	6	48	6	4	34	3	1	102
Summary punch	5	30	1	1	45	2	1	85
Console operation	8	47	6	1	50	3	1	116
Access devices	4	28	7	2	22	2	0	65
Converting equipment	2	14	3	2	22	1	0	44
Paper tape equipment	3	10	5	1	21	1	1	42
Data processing concepts	22	183	16	36	63	23	5	348
Programming	7	63	13	11	11	6	3	114
Data processing applications	6	36	1	4	32	4	4	87
Accounting	1	1	1	29	11	5	7	55
Management	6	4	0	30	35	12	15	102
Other business courses	0	1	0	36	7	3	10	57
Totals	109	661	91	163	739	70	70	1,903
Per Cent	5.7	34.7	4.8	8.6	38.8	3.7	3.7	

Table 11-5. Amount of Work Experience Reported by Data Processing Managers

Amount of Experience	In Data Processing	Total with Present Company
Up to 1 year	3	11
1 - 3 years	13	30
3 - 5 years	19	26
5 - 9 years	54	37
10 or more years	73	58
Total	162	162

PERSONAL CHARACTERISTICS

According to the executives in charge of data processing, data processing managers think logically, they get along well with people; to a lesser extent the executives said that data processing managers are creative and accept challenge in their work.

Leisure time activities of the data processing managers seem to be of an active nature. They indicated as outside interests such things as participation in sports and hiking and camping; also mentioned quite often as a leisure time activity was reading. These managers enjoy working puzzles, with less than 3 per cent of them saying they "hated" them; the rest said that puzzles were "O.K." or they enjoyed them.

ATTITUDES TOWARD DATA PROCESSING AS AN OCCUPATIONAL FIELD

Perhaps reflecting the executives' characterization of the data processing managers as logical thinkers and people who get along with others, the things that these people like about their job are the problem solving aspects of it, the challenge the job presents, and liking their co-workers. They also like the variety in the job.

Data processing managers apparently like data processing as a field since over 93 per cent of them say they enjoy it and plan to remain in it (Table 11-6). Perhaps the satisfaction with their jobs is due to the fact that most of them received their training in data processing after they had started work in the field.

Table 11-6. Attitude Toward the Field of Data Processing Managers With and Without Data Processing Training

Training	Enjoy-Will Remain		Enjoy-Desire Change		Dislike-Will Remain		Dislike-Desire Change		Total
	N	%	N	%	N	%	N	%	
Without training	93	62.4	7	70.0	0		1		101
With training	56	37.6	3	30.0	0		0		59
Totals	149	93.1	10	6.3	0		1		160

SUMMARY

JOB: Data Processing Manager

Duties:

1. Operate
    a. Computer
    b. Sorter
    c. High Speed Printer

2. Confer regarding
    a. Computer
    b. Key Punch

3. Supervise
    a. Computer Personnel
    b. Auxiliary Equipment Operator
    c. Key Punch

4. Analyze
    a. Flow of Data
    b. Systems

5. Schedule Computer Time and Use

Supervision Required:

Only as Needed

Education:

Minimum: High School

Desired: College Graduate

General Courses (High School):
1. General Mathematics
2. Advanced Mathematics
3. English
4. Oral and Written Communications
5. Psychology

Education (continued):

Business Courses (High School):
1. Bookkeeping
2. Business Mathematics
3. Typing

General Courses (Post High School):
1. General Mathematics
2. English
3. Social Science

Business Courses (Post High School):
1. Data Processing Equipment
2. Accounting Principles
3. Business Mathematics
4. Principles of Management

Management Recommendations:
1. Introduction to Systems
2. Statistics
3. Introduction to Business
4. Principles of Management
5. Intermediate Accounting
6. Principles of Finance

Experience:

Minimum: 36 months

Desired: 36 months

Personal Characteristics:

1. 93 per cent are men.

2. Jobs attained through promotions, manufacturers' recommendations, ads, private employment agencies.

3. Data Processing Manager should be logical thinker and have the ability to get along with people.

4. Most feel education was adequate.

5. The data processing manager likes best the problem-solving and challenge factors of his job.

Personal Characteristics (continued):

6. Hobbies are hunting, fishing, participation in sports, and reading. Puzzles are enjoyed.

7. The median age is 33 years.

Promotional Probabilities: Average to Little or None

Promoted to Supervisor.

Education has a definite effect upon promotion.

Salary:

Median:	$741

4

CHAPTER XII

THE SYSTEMS ANALYST*

Systems analysts are, as a rule, men (92 per cent), who obtained their jobs primarily through promotion, by answering advertisements, and through the services of private employment agencies.

CHARACTERISTICS OF THE JOB OF THE SYSTEMS ANALYST

Primarily the duties performed by a systems analyst in his job are analyzing systems and data flow and preparing flow charts, making block diagrams and preparing programs. The systems analyst confers with other people regarding use of the computer and the preparation of data for it. He debugs programs and codes for programs and tests sample routines.

The systems analysts in this study reported using several program languages in their programming duties, of which autocoder was used by more of the analysts than the other languages, with COBOL and machine language ranking next in order of use, each by about half as many analysts as used autocoder.

Work Experience Required Prior to Employment

Systems analysts are expected to have considerable data processing experience in order to qualify for their jobs (Table 12-1). Only 27 per cent of the managers indicated that, even with the shortages of systems analysts, they would of necessity consider someone with only up to six months of data processing experience. Over half of them said that at least a year of previous work in data processing was the minimum they would accept, and over 35 per cent felt that more than two years of experience was a necessity.

However, if they could get employees with the amount of experience they really felt was desirable, 75 per cent of the managers indicated that applicants for the job of systems analyst would have more than one year of previous employment in data processing, 55 per cent said more than two years, and almost 40 per cent said three years or more of data processing experience.

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*The job description of the systems analyst is based on the data collected in this study and previously displayed and analyzed in earlier chapters of this report.

Table 12-1. Amount of Data Processing Experience Prior to Employment as a Systems Analyst (% of managers indicating stated amount)

Months	Minimum Acceptable	Amount Preferred
0 - 6	27.1	14.3
7 - 12	17.1	10.0
13 - 24	19.9	20.0
25 - 36	18.6	17.1
37+	17.1	38.6

Educational Requirements

More systems analysts hold college degrees than do the individuals in any of the other job categories, with 40.6 per cent holding at least a bachelor's degree. Another 47 per cent have had some education beyond high school but have not completed work for a degree. This educational level held by the systems analyst, however, does not meet the standards preferred by the data processing managers, of whom 87 per cent felt that people in this job should have a least a bachelor's degree.

However, the education completed by systems analysts does meet the minimum standards acceptable to the data processing managers, in that 38 per cent feel that college degree is a minimum amount of education necessary for people in this job, and another 30 per cent say they will consider someone for the job of systems analyst if he has some education beyond high school but not necessarily a degree.

General education. Systems analysts felt that general mathematics was the most valuable general education course they had studied in school, and they felt generally that they should have had more work in advanced mathematics. English, too, ranked high on the list of helpful courses, next to mathematics. This agrees with what management feels to be the most beneficial of the general education courses, although they emphasize the need for good oral communications especially. The systems analysts rank English second in the list of courses in which they wish they had more work. These courses ranked the same in importance at both the high school and post high school levels.

Business courses. Of the business courses considered to be helpful in their jobs, systems analysts mentioned most frequently accounting at the post high school level and bookkeeping in the high school, along with business mathematics at both levels. Of the courses they had had in college, these people have found courses in data processing equipment and data processing applications the most helpful, and statistics is mentioned by quite a number of these employees as being a useful course for their kind of work.

Management, however, felt that systems analysts should study more management courses, including introduction to systems, principles of management and personnel management. They felt, too, that records management and a second year of accounting would be desirable preparation in business for these people.

Promotion, Overtime, Supervision, and Salaries

The systems analyst has a high to average probability of being promoted, according to the managers of data processing departments in which they work, with more of them saying the probability of promotion is high. Over 40 per cent of the managers said that education has a definite bearing on promotability of the systems analyst, while about the same number say that education has "quite a bit" or some influence on promotions of these people.

The systems analyst is likely to be promoted to some higher level supervisory job, to a data processing management position, or to project director.

Most systems analysts are required to work a little overtime. Only 17 per cent of the managers said that their systems analysts worked only regular business hours. Most of them (46 per cent), however, said these employees in their departments work up to seven hours a week overtime, but about 13 per cent said that their employees work more than 12 hours weekly outside of regular hours.

Systems analysts work more or less independently and require little supervision, or according to the data processing managers, "only as needed."

The median salary for systems analysts is $817 a month (Table 12-2). However, the median salary paid systems analysts who hold a college degree is considerably higher than the general median ($839); and those without a degree but with some work beyond high school have a median salary of $790.

The median salary is about $100 a month ($831) more for those with more than three years of data processing experience than those without that amount of experience; however, the median salary for those analysts who have worked between three and ten years is about equal to the total group median, and those with over ten years of experience in the field have a median salary of $865 a month (Table 12-3).

Table 12-2. Salaries Paid Systems Analysts According to Levels of Education

Salary	Less than High School	High School	Post High School	Degree	Total
$400-499			1		1
$500-599		3	6	1	10
$600-699			7	3	10
$700-799		6	20	15	41
$800-899		5	22	13	40
$900-999		1	2	9	12
$1000+		2	7	15	24
Totals	0	17	65	56	138

Table 12-3. Salaries Paid Systems Analysts According to Amount of Data Processing Experience

Salary	Under 1 Year	1 - 3 Years	3 - 5 Years	5 - 9 Years	10 Years or More	Total
$400-499				1		1
$500-599		5	1	4		10
$600-699	1	3		5	1	10
$700-799	1	8	6	17	9	41
$800-899	2	2	10	12	14	40
$900-999		1		7	4	12
$1000+		2	4	7	11	24
Totals	4	21	21	53	39	138

Systems analysts have received most of their training in data processing in manufacturers' classes, both before and after they began working in the field; and some of these men received some data processing training in the military service.

Training Prior to Entering Data Processing

Systems analysts for the most part had their training in data processing after starting to work in the field. However, of the training they received before entering the data processing field, 23 per cent of the courses were received during military service, especially on unit record equipment and in card punching (Table 12-4). The greater portion of the training was received, however, at manufacturers' schools, with more of these individuals having learned data processing concepts there than anywhere else. More of them had received their unit record equipment training in the military service than in schools, however. Most programming was learned at a manufacturer's school, as was operation of the computer.

Training After Entering Data Processing

Following initial employment in the field of data processing, most of the systems analysts' training was at manufacturers' schools, but almost as much was done on the job (Table 12-5). Only eight per cent of the courses were offered as classes run by the companies themselves, and about three per cent of the training was in classes in local institutions for which the company paid the fees; and about ten per cent of the courses were taken by these employees in local education institutions and paid for by the employee himself. Most of the courses studied by these people dealt with the computer, programming, data processing concepts, and data processing applications.

Evaluation of Their Education

The systems analysts felt for the most part that their educational background was adequate (about 55 per cent), with about 16 per cent of them indicating that they were very well prepared. Although almost 30 per cent felt that they had not been trained adequately for their jobs, those who had had data processing courses before going into the field were more satisfied with their education. Less than 20 per cent of those with data processing training said they had been inadequately prepared for work in the field, while 35 per cent of those without prior data processing training felt this way.

Table 12-4. Training and Place of Training of Systems Analysts in Data Processing Prior to Entering the Field

Training	High School	High School Part-time	College	Special Data Processing School	Private Business School	Equipment Manufacturing	Military	Place Not Given	Total
Key punch simulator	0	0	0	1	0	3	0	0	4
Key punch machine	0	0	2	4	2	9	11	0	28
Card sorter	0	0	1	6	3	7	11	0	28
Unit records	0	0	4	23	12	36	47	0	122
Wiring boards	0	0	1	5	2	11	7	0	26
Console operation	0	0	1	1	0	17	6	0	25
Access devices	0	0	1	1	1	13	5	0	21
Data converting	0	0	0	0	0	11	2	0	13
Paper tape equipment	0	0	0	0	0	8	2	0	10
Data processing concepts	4	0	51	13	7	72	18	0	165
Programming	0	0	6	4	1	28	3	0	42
Totals	4	0	67	58	28	215	112	0	484
Per Cent	0.8	0	13.8	12.0	5.8	44.4	23.1	0	99.9

Table 12-5. Training and Place of Training of Systems Analysts in Data Processing After Entering the Field

Training	Company's Classes	Manufacturer's School	Manufacturer's Representative	Local School	On-the-Job	Sent to Local School	Other	Total
Key punch simulator	0	2	0	0	3	0	0	5
Key punch machine	8	7	0	1	50	0	6	72
Card sorter	11	13	0	2	53	0	4	83
Unit record	30	121	9	12	185	1	18	376
Wiring boards	5	33	2	1	24	1	6	72
Summary punch	4	24	2	2	23	0	2	57
Console operation	3	39	7	1	43	0	5	98
Access devices	2	43	10	1	7	1	2	66
Converting equipment	2	18	2	0	11	0	4	37
Paper tape equipment	3	10	4	1	14	0	7	39
Data processing concepts	38	158	26	45	64	16	33	380
Programming	11	79	12	6	9	3	3	123
Data processing applications	5	24	2	6	38	1	4	80
Accounting	1	0	0	22	8	7	7	45
Management	11	3	0	31	16	11	13	85
Other business courses	4	2	0	36	6	10	17	75
Totals	138	576	76	167	554	51	131	1,693
Per Cent	8.2	34.0	4.5	9.9	32.7	3.0	7.7	

DATA PROCESSING EXPERIENCE

Of the 30 systems analysts who had been with their company for less than a year, only four had had that little amount of data processing experience (Table 12-6). Most systems analysts had worked more than a year in data processing, with over 80 per cent of them with more than three years' experience, and nearly two-thirds of them had been in the field for more than five years. Nearly 60 per cent of the systems analysts had been with the company for more than three years, and 47 per cent had had more than five years' employment with their firms. A greater proportion of the systems analysts had had this amount of data processing experience, so apparently business is able to recruit experienced data processing personnel into this position.

Their experience in data processing, however, has been mainly in the operation of unit record equipment and in programming, with about one-fourth of them reporting experience in these areas. Slightly over a fourth of the analysts (26.4 per cent) had had experience in systems analysis prior to this job, and 15 per cent had served in a supervisory capacity.

Table 12-6. Amount of Work Experience Reported by Systems Analysts

Amount of Experience	In Data Processing	Total with Present Company
Up to 1 Year	4	30
1 - 3 Years	21	28
3 - 5 Years	21	15
5 - 9 Years	53	28
10 or More Years	38	37
Totals	138	138

Prior to entering into the field of data processing, systems analysts had worked in the sales and services occupations, accounting and clerical fields, and some had had supervisory experience in other areas of business.

PERSONAL CHARACTERISTICS

According to data processing managers, systems analysts get along well with people, they are logical thinkers, they are creative and accept challenge. To a lesser extent, managers named emotional stability (in that they can work under pressure) as characteristic of systems analysts.

Systems analysts, whose jobs require little physical activity and much concentration, seem to have leisure time interests of a more active nature. They indicated as outside interests such things as participation in sports; outdoor activities such as hunting, fishing and camping; what might be classified "household activities" such as furniture refinishing, interior decorating, and gardening. Also mentioned quite often as leisure time activities were arts and crafts and reading. Systems analysts enjoy working puzzles, with less than one per cent of them saying they "hated" them; the rest said that puzzles were "O.K." or they liked them.

ATTITUDES TOWARD DATA PROCESSING AS AN OCCUPATIONAL FIELD

Perhaps reflecting the managers' characterization of the systems analysts as logical thinkers, and people who are creative and who accept challenge, the things that these people like about their jobs are the problem-solving aspects of it and the challenge it presents. They also like the variety in the job.

Systems analysts apparently like data processing as a field since over 90 per cent of them say they enjoy it and plan to remain in it (Table 12-7). Those without data processing training before going into the field express about the same degree of satisfaction as those with prior training, perhaps because most of their training in data processing was received by these people after they had started work in the field.

Table 12-7. Attitude of the Systems Analyst Toward Data Processing Work

Training	Enjoy-Will Remain		Enjoy-Desire Change		Dislike-Will Remain		Dislike-Desire Change		Total
	N	%	N	%	N	%	N	%	
Without Training	78	62.0	7	53.8	0	0	0	0	85
With Training	47	37.+	6	46.2	0	0	1		54
Totals	125	90.5	13	8.6	0	0	1		139

SUMMARY

JOB: Systems Analyst

Duties:

1. Analyze systems and flow charts
2. Make flow charts
3. Make block diagrams
4. Prepare program
5. Debug programs
6. Code for programming
7. Test sample routines
8. Confer regarding
    a. Computer
    b. Key Punch

Supervision Required:

Only as needed

Education:

Minimum: College Degree

Desired: College Degree

General Courses (High School):

1. General Math
2. Advanced Math
3. English
4. Oral and Written Communications
5. Algebra
6. Logic

General Courses (Post High School):

1. General Math
2. English
3. Psychology
4. Advanced Math
5. Social Science

Business Course (High School):

1. Business Math
2. Bookkeeping
3. Introduction to Business

(Least helpful were typing and shorthand; some said bookkeeping)

Business Courses (Post High School):

1. Accounting Principles
2. Statistics
3. Data Processing Equipment

(Least helpful were personnel management, finance, and marketing)

Management Recommendations for Business Courses:

1. Introduction to Systems
2. Principles of Management
4. Records Management
5. Statistics
6. Introduction to Business
7. Second-year Accounting

(Not many responses indicating finance and advanced accounting courses needed)

Experience:

Minimum: 12 to 36 Months

Desired: Over 3 Years

Personal Characteristics:

1. 92% are men.

2. Jobs attained through promotion, ads, and private employment agencies.

3. Systems Analysts are logical thinkers and have the ability to to get along with people.

4. Most enjoy their jobs and wish to remain; this attitude differed little whether or not they had data processing training.

5. Systems Analysts feel to a certain extent that their education is adequate; 30% felt inadequately prepared by schools.

6. The Systems Analyst likes best the problem-solving factor of his job.

7. Hobbies are things requiring physical movement and reading; he enjoys puzzles.

8. The median age is 33 years.

9. The programming languages most frequently used: Autocoder, COBOL and machine language.

Salary:

Median: $810

(Salary ranges of $700-799 and $800-899 most often reported. These two ranges, $700-900 together, covered 58% of Systems Analysts.)

Men: $820
Women: 750

(Men earned within the entire scale, $400-1000; women earned within the scale of $500-900. Twenty-four men earned $1000 or more; no women.)

High School: $790
Post High School: 790
Degree: 869

1-10 Years $700-900
10+ Years 800-899

(There is no general trend indicating higher salary ranges as years worked for company increases.)

PART III

CHAPTER XIII

CURRENT DATA PROCESSING INSTRUCTIONAL PROGRAMS

STATUS OF DATA PROCESSING INSTRUCTION

In order to gather information about the status of data processing instruction in the public schools of the United States, both at the secondary and the two-year post high school levels, the interviewers talked with heads of data processing instructional departments in 72 high schools, 32 vocational technical schools and 72 junior colleges. The department heads were asked to have the teachers in his department fill out questionnaires concerned with their background, training in business, work experience, and teaching duties. Questionnaires were completed by 259 teachers from two-year post high school institutions and 172 from the 72 high schools. These schools were in the cities in which the businesses were located where the data processing managers were interviewed or were within a 25-mile radius of these cities.

Many of these schools had initiated data processing instructional programs before passage of the Vocational Education Act of 1963, with slightly over 30 per cent of the instructional programs having been begun since 1964, at which time federal funds were available for the purchase of equipment and supplies for instructional purposes (Table 13-1). Apparently the schools in which interviews were conducted had rather early seen the need for instruction in this field. Three of them offered work in data processing as early as 1958 and 14 more started programs in 1959. Of the schools included in this study, only three had started data processing programs as late as 1966. Prior to 1962 proportionally more programs were developed at the post high school level (about 58 per cent) than at the high school level (about 40 per cent). However, relatively more high school programs started in 1963 than did post high school programs so the proportion of programs started by that time was the same in all types of schools.

Location of Data Processing Instructional Programs

Over half (52 per cent) of the schools in which interviews were held were in three sections of the country: the Middle Atlantic States, the East North Central States, and the Pacific States. This proportion is very close to that found in the census survey conducted prior to the interviews. In that survey, 50.7 per cent of the programs reported were in these three sections of the country (Table 13-2). If the projection of anticipated programs reported in the census survey may be considered valid, by 1969 a total of 60 per cent of the programs in data processing in public schools in the United States will be located in the schools in these three regions of the United States. In the country as a whole, 22 per cent of the schools reported that they definitely will have or are

Table 13-1. Number of Data Processing Instructional Programs Begun in the Years from 1958 to 1967.

Year	High School		Voc-Tech School		Junior College		Total	
	N	%	N	%	N	%	N	%
1958	1	1.4	1	3.2	1	1.4	3	1.7
1959	4	5.6	4	12.9	6	8.3	14	8.0
1960	3	4.2	1	3.2	4	5.6	8	4.6
1961	11	15.3	5	16.1	14	19.4	30	17.1
1962	10	13.8	7	22.6	16	22.2	33	18.8
1963	19	26.4	4	12.9	9	12.5	32	18.3
1964	15	20.8	6	19.4	11	15.3	32	18.3
1965	8	11.1	3	9.7	8	11.1	19	10.8
1966	1	1.4	0		2	2.8	3	1.7
1967	0		0		1	1.4	1	0.6
Totals	72	100.0	31*	100.0	72	100.0	175	

*Data not available from one vocational-technical school.

Table 13-2. High Schoools, Public Junior Colleges and Vocational Schools Offering or Planning Data Processing Course Work

Area	High Schools						
	High Schools	Offering Courses	%	Anticipated	%	Total	%
New England	508	102	20	76	15	178	35
Middle Atlantic	1451	232	16	255	18	487	34
South Atlantic	644	44	7	58	9	102	16
E. So. Central	492	8	2	28	6	36	7
W. So. Central	1237	26	2	63	5	89	7
W. No. Central	1797	80	4	145	8	225	13
E. No. Central	2248	146	6	274	12	420	19
Mountains	458	28	6	52	11	80	17
Pacific	649	75	12	90	14	165	25
Total	9484	741	8	1041	11	1782	19

Area	Public Junior Colleges & Vocational Schools						
	Schools	Offering Courses	%	Anticipated	%	Total	%
New England	40	14	35	4	10	18	45
Middle Atlantic	100	56	56	11	28	67	67
South Atlantic	126	62	49	19	15	81	64
E. So. Central	54	18	33	10	19	28	52
W. So. Central	52	25	48	1	2	26	50
W. No. Central	102	29	28	18	18	47	46
E. No. Central	157	78	50	13	13	98	62
Mountain	38	13	34	16	16	19	50
Pacific	114	79	69	13	13	94	82
Total	783	374	48	13	13	478	61

anticipating beginning a data processing instructional program by 1969. By this date, over 60 per cent of the public post high school institutions anticipate offering some instruction in data processing and about 19 per cent of the high schools plan such course work (Table 13-2).

A direct relationship seemed to exist between the size of the high school and the likelihood of its offering work in data processing, both in current and anticipated programs. By 1969, over half (57 per cent) of the high schools with over 1,500 students will offer or anticipate offering data processing instruction (Table 13-3); these figures range downward to seven per cent in high schools with enrollments of less than 300.

With the exception of the very largest junior colleges and vocational technical schools, the same trend is apparent at the post high school level, in that the larger the school, the more likely it offers or anticipates offering data processing. By 1969 nearly all two-year post high school institutions with enrollments between 1,000 and 1,500 students will have or plan to have data processing courses, and over half of all the post high school institutions are offering or plan to offer work in data processing by the year 1969.

INSTITUTING THE DATA PROCESSING CURRICULUM

When asked by the interviewers for the primary reason for starting data processing instruction in their schools, they reported that such programs were initiated because industry needed trained personnel in this field, with 89 out of 171 replies indicating this. About an eighth of the schools established the need for such a program through a community survey; and 20 of the schools (11.7 per cent) said that such courses were needed to update the curriculum (Table 13-4), this last answer being more prevalent among the secondary schools than in the post secondary institutions.

Considering all schools together, the administrators were in the main responsible for initiating the data processing instructional programs, according to the replies given by the data processing personnel interviewed in the schools, with 73 out of 176 schools (41.5 per cent) indicating thus (Table 13-5). On the other hand, in 45 schools (25.6 per cent) the business education faculty was reported to have provided the main impetus for starting the data processing instructional program. However, in the junior colleges, the business teachers were the people who tended to initiate data processing programs to a slightly greater degree than did the administrators (25 and 23 out of 72, respectively). However, administration together with the business education faculty generally provided the impetus for initiating data processing courses in their schools in that in nearly three-fourths of the schools these were the people credited with getting the program started.

Table 13-3. Number of High Schools, Public Junior Colleges and Vocational Schools Offering or Planning Data Processing Course Work. (Schools of Different Sizes)

	High Schools						
School Size	N	D.P. Courses	%	Anticipated	%	Total	%
1- 299	3441	93	3	159	5	252	7
300- 599	2276	126	6	257	11	383	17
600- 999	1219	114	9	224	18	338	28
1000-1499	720	120	17	160	22	280	39
1500+	904	256	28	261	29	517	57
Total	8560	709	8	1061	12	1770	21

	Public Junior Colleges & Vocational Schools						
School Size	N	D.P. Courses	%	Anticipated	%	Total	%
1- 299	277	73	26	38	14	111	40
300- 599	165	64	39	28	17	92	56
600- 999	129	62	48	24	19	86	79
1000-1499	108	88	81	11	10	99	92
1500+	75	43	57	3	4	46	61
Total	754	330	44	104	14	434	58

Table 13-4. Primary Reason for Initiating an Instructional Program in Business Data Processing

Reason	High Schools	Voc-Tech Schools	Junior Colleges	Total
Need for trained personnel	33	15	41	89
Could place students	2	2	1	5
To update curriculum	12	1	7	20
Interest of teachers in data processing	2	0	2	4
Community survey showed need	7	2	11	23
Other	14	6	10	30
Totals	70	29	72	171

Table 13-5. Persons Responsible for Initiating Data Processing Instructional Programs

Persons Responsible	High Schools	Voc-Tech Schools	Junior Colleges	Total
Administration	32	18	23	73
Business education faculty	18	2	25	45
Administration and business education faculty	6	1	3	10
Business and industry	5	3	4	12
Advisory committee	3	3	3	9
Other	8	5	14	27
Total	72	32	72	176

Objectives of Data Processing Instruction

Providing vocational preparation in the field of data processing is the objective of data processing instruction in all three types of schools. This question was asked as an open-end, free-response question; and in all of them, except two, if not specifically using the word "vocational," it is implicit in the statements, summarized in Table 13-6. Only 23 responses out of 176 indicated that the primary objective of data processing instruction was to provide a general knowledge about data processing or to provide acquaintanceship level of machine operating skill. Among the "Other" responses were such things as vocational training for and upgrading of present employees and providing background for further study.

Table 13-6. Primary Objective of Data Processing Instruction

Objective	High Schools	Voc-Tech Schools	Junior Colleges	Total
Vocational preparation of students	44	27	47	118
Provide general knowledge	10	1	7	18
Provide acquaintanceship level of skill in equipment operation	3	0	2	5
Vocational preparation and provide general knowledge	5	2	9	16
Vocational preparation-retraining	3	1	0	4
Other	7	1	7	15
Total	72	32	72	176

When the decision had been made to include data processing instruction in the curriculum, the different schools chose different approaches to the introduction of such instruction. Vocational-technical schools tended to organize a series of courses, whereas junior colleges and high schools began their data processing instruction mainly through the inclusion of an introductory course in the curriculum (Table 13-7).

Table 13-7. Ways Data Processing Instruction Was Introduced into Curriculum.

Ways	High Schools N	High Schools %	Voc-Tech Schools N	Voc-Tech Schools %	Junior Colleges N	Junior Colleges %	Total N	Total %
Introductory course	28	45.9	8	25.8	27	41.5	63	40.1
Sequence of courses	10	16.4	13	41.9	22	33.8	45	28.7
Unit in another class	14	22.9	5	16.1	2	3.1	21	13.3
A complete curriculum	2	3.3	5	16.1	9	13.8	16	10.2
Mentioned in other classes	4	6.6	0		0		4	2.5
Other	3	4.9	0		5	7.7	8	5.1
Total	61	100.0	31	99.9	65	99.9	157	99.9

About 10 per cent of the schools said they introduced a complete curriculum in data processing when introducing this instructional field into the curriculum. High schools tended more so than other schools to introduce data processing as a unit in other courses.

Problems in Establishing and Operating a Data Processing Program

Getting teachers, financing the program, and selecting equipment ranked, in that order, as the leading problems in establishing data processing programs in high schools and junior colleges (Table 13-8). Vocational schools reported more frequently than other schools that fixing responsibility for equipment maintenance was an initial problem. Junior colleges apparently had slightly more of a problem in getting teachers than did high schools, perhaps because junior colleges tended to offer more advanced work than did the high schools. However, high schools reported more problems in financing the program than did the junior colleges or vocational schools. Selecting equipment appeared to be more of a problem for the junior colleges than for the other kinds of schools, again perhaps because many high school programs were limited primarily to key punch instruction and introduction to data processing courses.

Table 13-8. Administrative Problems in Establishing the Data Processing Instructional Program.

Problem	High Schools		Voc-Tech Schools		Junior Colleges		Total	
	N 72*	%	N 32*	%	N 72*	%	N 176*	%
Getting teachers	37	51.4	17	53.1	41	56.9	95	54.0
Financing	34	47.2	12	37.5	28	38.9	74	42.0
Selecting equipment	16	22.2	7	21.9	21	29.2	44	25.0
Fixing responsibility for maintenance of equipment	11	15.3	10	31.2	8	11.1	29	16.5
Selling program to administration	7	9.7	2	6.2	10	13.9	19	10.8
Scheduling administrative and instructional time on equipment	4	5.6	1	3.1	9	12.5	14	8.0
Selling program to the public	5	6.9	3	9.4	4	5.6	12	6.8
Other	4	5.6	3	9.4	4	5.6	11	6.2

*Columns add to more than N since the schools may have listed more than one problem.

However, in operating the program, the relative importance of the problems shifted slightly, although getting teachers was still the number one problem in all three types of schools (Table 13-9). In operating the program (perhaps as programs expanded) high schools found that selecting equipment after the program was underway was more of a problem than it had been in establishing the program, and financing ranked third as a problem in operating the program in high schools. On the other hand, both junior colleges and the vocational technical schools indicated that financing the program was the second most serious problem and allocating and scheduling time on the equipment for administrative and instructional purposes ranked either second or third.

Table 13-9. Administrative Problems in Operating a Data Processing Instructional Program.

Problem	High Schools		Voc-Tech Schools		Junior Colleges		Total	
	N 72*	%	N 32*	%	N 72*	%	N 176*	%
Getting teachers	31	43.1	22	68.8	46	63.9	99	56.2
Financing	13	18.1	7	21.9	22	30.6	42	23.8
Scheduling administrative and instructional time on equipment	10	13.9	7	21.9	20	27.8	37	21.0
Selecting equipment	14	19.4	4	12.5	10	13.9	28	15.9
Fixing responsibility for equipment maintenance	9	12.5	1	3.1	13	18.1	23	13.1
Selling program to administration	7	9.7	1	3.1	5	6.9	13	7.4
Getting maintenance service on equipment	3	4.2	2	6.2	5	6.9	10	5.7
Other	1	1.3	3	9.4	4	5.6	8	4.5

*Columns add to more than N since the schools may have listed more than one problem.

Among the less frequently mentioned administrative problems both in establishing and in operating the data processing instruction program were those of fixing the responsibility for maintaining the equipment and selling the administration on the program. This last seems a bit inconsistent with the previous statement that the administrative people provided the primary impetus in initiating the data processing instructional programs.

Curricular and instructional problems. Philosophical differences among the several departments concerned with use of the data processing equipment (mathematics, science, engineering, business, etc.) was either the first or second ranked curricular problem reported by all three types of schools (Table 13-10). While developing appropriate curricula was the main problem among the high schools and vocational-technical schools, this was ranked fifth among the responses from the junior colleges. Other curricular and instructional problems included such things as scheduling the students on the equipment (too many students for the amount of equipment available), determining who should be admitted to the data processing programs, and keeping updated.

Table 13-10. Curricular and Instructional Problems in Operating a Data Processing Instructional Program.

Problem	High Schools N 72	 %	Voc-Tech Schools N 32	 %	Junior Colleges N 72	 %	Total N 176	 %
Philosophic differences among departments involved	31	43.1	14	43.8	29	40.3	74	42.0
Curriculum	36	50.0	14	43.8	14	19.4	64	36.4
Scheduling students on equipment	23	31.9	8	25.0	15	20.8	46	26.1
Selecting students for the program	18	25.0	8	25.0	16	22.2	42	23.9
Keeping updated	11	15.3	6	18.8	18	25.0	35	19.9
Placement of students on job	6	8.3	4	12.5	3	4.2	13	7.4
Lack of student interest	4	5.6	1	3.1	4	5.5	9	5.1
Other	11	15.3	9	28.1	25	34.7	45	25.6

Changes in curriculum. Teachers in all three types of schools reported that necessary changes in the data processing curriculum were determined mainly by talking with businessmen (Table 13-11). This basis for curriculum change was the most frequently reported, especially among the vocational schools and the junior colleges. Talks with other data processing teachers apparently gave data processing personnel ideas for needed curriculum changes also, since this was ranked second as the basis for curriculum change, although it was named only about one-third as often as talking with businessmen. Some schools did follow-up studies of students and some followed suggestions for curriculum made by equipment manufacturers.

Table 13-11. Bases for Making Curricular Changes.

Basis for Change	High Schools		Voc-Tech Schools		Junior Colleges		Total	
	N 72	%	N 32	%	N 72	%	N 176	%
Talks with businessmen	29	40.3	22	68.8	56	77.8	107	60.8
Talks with other data processing teachers	13	18.0	3	9.4	15	20.8	31	17.6
Follow-up studies of students	13	18.0	4	12.5	12	16.7	29	16.5
Suggestions from equipment manufacturers	8	11.1	4	12.5	12	16.7	24	13.6
Evaluation by teachers	8	11.1	3	9.4	7	9.7	18	10.2
Reading journals	9	12.5	1	3.1	8	11.1	18	10.2
Reading research	5	6.9	1	3.1	9	12.5	15	8.5
Administrative directives	7	9.7	0		2	2.8	9	5.1

Differences Between Adult Evening School and Regular Data Processing Programs. Among the schools that offer adult evening programs in data processing, most indicated that they offer the same program in both the evening and day classes, with this tendency being the greatest among the junior colleges, with 48 out of 64 responses indicating this practice (Table 13-12). Eleven out of 64 responses from high schools indicated that they offer the same program for adults as they do in the daytime programs; however, the same number said that a different approach and emphasis was used in adult classes. A greater proportion of the high school responses said that adults work at a faster pace than regular students, but this was not true in the post high school institutions.

Table 13-12. Differences Between Adult Evening School and Regular Data Processing Programs*

Differences	High Schools N=48	Voc-Tech Schools N=18	Junior Colleges N=40	Total N=106
Different approach and emphasis	11	54	8	23
More advanced work	5	4	3	12
Fewer courses available to adults	2	7	3	12
Work presented at a slower pace	4	6	1	11
Work presented at a more rapid pace	8	2	0	10
More courses available to adults	4	1	4	9
Work presented in larger blocks	4	3	1	8
More hands-on experience for adults	2	0	1	3
Other	13	4	5	22
No difference	11	5	48	64

*Respondents could make more than one response to this question.

In other areas of possible difference between adult and regular programs, no consistency was found. For example, nine schools said that more courses were available to adults; 12 said that fewer courses were offered to these students; ten schools indicated that adults work at a more rapid pace, but 11 said that the work was offered at a slower pace.

Reasons for adult programs in data processing. According to data processing instructional personnel in schools offering adult evening courses, the adult students are enrolled primarily to obtain the necessary background and skills to upgrade themselves from their present jobs (Table 13-13). Following closely in frequency of number of times mentioned is that these people are taking evening school courses in order to change jobs; that is, for the purpose of moving from their present jobs into the field of data processing.

Table 13-13. Reasons Given by Adult Evening Students for Enrolling in Data Processing Courses*

Reasons	High Schools N=48	Voc-Tech Schools N=18	Junior Colleges N=40	Total N=106
Upgrading: moving from one data processing job to another	25	20	50	95
Retraining: moving from present job into a data processing job		11	41	84
Pre-employment training	24	9	32	65
Updating managers and accountants	4	3	16	23
Interested and curious: want general understanding	12	7	16	35
Other	1	1	10	12

*Respondents may have given more than one reason.

The reasons vary in importance according to the type of school. The most important function of the night school classes in the vocational-technical schools is given to upgrading within the data processing field, while the high schools claimed that the reason adults enroll in their evening school courses is for retraining; that is, employed adults get training in data processing in order to move from their present jobs into data processing. About an equal proportion of the responses indicated pre-employment training in all three kinds of schools, but the junior colleges indicated to a greater extent than the others that their courses provided updating for managers and accountants.

DATA PROCESSING STUDENTS

Table 13-14 shows the grade levels at which students study data processing in the three kinds of schools, including night school classes and MDTA programs. A few of the high schools permit youngsters as low as the tenth grade to take data processing courses. Adult evening courses are relatively popular, in that over 50 per cent of each of the three types of schools offer adult evening courses in data processing. A few of the vocational-technical schools offer work to high school students as well as to those at the post high school level.

Table 13-14. Grade Level of Students in Data Processing Courses

Grade Level	High Schools N=72	Voc-Tech Schools N=32	Junior Colleges N=72	Total* N=176
Secondary				
11th and 12th	34	1	0	35
12th	19	6	0	25
10th, 11th, 12th	8	2	1	11
Post High School				
Adult evening	48	18	40	106
13th and 14th	7	28	66	101
Pre-employment night	14	12	44	70
MDTA	2	3	0	5
Totals	134	70	151	355

*Since schools may have had both day and evening classes, totals are greater than the number of schools interviewed.

Selection of Students

Of the 176 schools in the study, over one-third of them reported screening of students for entry into the data processing program (Table 13-15). High Schools tend to be more selective than are the post high school institutions, with slightly over 70 per cent of the 72 high schools using some criterion for selecting students, while only about 45 per cent of the 104 post high school institutions reported having admission standards.

Although not widely used, the most popular method of selecting students is on the basis of test scores. The test used by most of the schools, 48 out of 176, was a programming aptitude test (Table 13-16). Half that number, 24 schools, indicated that they used "company" tests; that is, data processing aptitude tests provided by equipment manufacturers; and 20 schools said they used general scholastic aptitude test scores for selecting students for their data processing programs.

Some of the schools indicated that certain courses were prerequisites for entry into the study of data processing (Table 13-17). To a certain extent, mathematics is a prerequisite, especially in the vocational-technical schools. Over half the vocational-technical schools and about one-third of the junior colleges specify mathematics as a prerequisite, while about a fourth of the high schools say that students must have studied mathematics before entering the data processing program.

Typing ranks second as a prerequisite, with its being required in 27 high schools (37.5 per cent); and 12 out of the 32 vocational schools (38.7 per cent) listed typing as a prerequisite course. However, only five junior colleges named typing as a course necessary for entrance into data processing courses.

Bookkeeping and accounting were required for entry into data processing by one-fourth of the high schools and an eighth of the junior colleges, and five out of the 32 vocational-technical schools specified bookkeeping or accounting as a prerequisite. Other courses were infrequently mentioned perhaps because some of these courses were the general education ones that are required of all students in many schools, no matter what the major interest of the students is.

Table 13-15. Bases for Selecting Students for the Data Processing Programs*

Basis for Selection	High School N=72	Post High School N=104	Total N=176
Test scores	23	44	67
Grade point average (specified courses)	19	7	26
Grade point average (over-all)	13	10	23
Counseling and advising	16	5	21
Selected background courses	5	12	17
Personal characteristics	10	5	15
Other	4	12	16
No selection done	21	57	78

*Totals are greater than number of schools because some schools used more than one criterion in the student selection procedure.

Table 13-16. Kinds of Aptitude Tests Used in the Selection of Data Processing Students.

Tests	High Schools N=72	Voc-Tech Schools N=32	Junior Colleges N=72	Total N=176
Programming aptitude	12	21	15	48
"Company" tests	16	5	3	24
Scholastic aptitude	5	4	11	20
Math aptitude	3	4	6	13
Unspecified aptitude	4	9	0	13
Interest inventories	1	3	2	6
Logic	1	2	0	3
Other	2	1	1	4

Table 13-17. Prerequisites for Entry into Data Processing Courses

Prerequisite	High Schools N=72	Voc-Tech Schools N=32	Junior Colleges N=72	Total N=176
Mathematics	19	15	21	55
Typing	27	12	5	44
Bookkeeping and/or accounting	18	5	12	35
English		2	2	4
Introduction to business	1		3	4
Office procedures	3		1	4
Science		2	2	4

Characteristics of Data Processing Students

When asked to describe the outstanding personal characteristics of data processing students, teachers most frequently mentioned that these students showed a greater degree of neatness in their work than other students (Table 13-18). The next most outstanding characteristic was that of persistence on the part of these students in problem solving; they were not content to leave a problem until it was complete. Data processing students tend to pay attention to detail, are logical thinkers, and display systematic work habits. To a lesser extent, teachers mentioned that data processing students were eager and interested; they liked puzzles or problem-solving activities; they tended to be creative; and a few teachers mentioned that these students were "machine happy"--they liked working with the equipment and making the machines perform properly and liked to use the machines to solve problems.

Table 13-18. Personal Characteristics of Data Processing Students

Characteristics	High Schools N=72	Voc-Tech Schools N=32	Junior Colleges N=72	Total N=176
Neatness in work	22	5	20	47
Persistence in problem solving	7	9	12	28
Pay attention to details	7	5	8	20
Logical thinkers	4	1	15	20
Systematic work habits	5	5	6	16
Eager, interested	5	4	4	13
Likes puzzle problem-solving activities	1	5	2	8
Creative	1	2	2	5
"Machine-happy"	2	0	2	4

Placement of Data Processing Students in Business

The schools help their data processing students in a variety of ways to get employment in the business world. Primarily the data processing department helps them or the schools have a placement service (Table 13-19). In 24 schools, students are placed in their jobs as a result of business contacting the schools asking for students to fill openings in their data processing departments. To a lesser extent the student personnel office acts as a placement bureau and helps locate jobs for the students, or the student hears about jobs openings through the data processing teachers. Some schools reported working with public employment agencies and the advisory committee of the Data Processing Management Association helps students find jobs. However, 31 of the 176 schools reported that they provide no placement services.

Table 13-19. Job Placement Services Provided to Data Processing Students

Job Placement Method	High Schools N=72	Voc-Tech Schools N=32	Junior Colleges N=72	Total N=176
School has placement service	16	7	33	56
Department helps place students	19	8	9	36
Businesses contact school	9	6	9	24
Placed through student personnel office	5	3	6	14
Placed through teacher contacts	7	3	2	12
School works with publc employment agency	2	4	4	10
Advisory committee of D.P.M.A.	2	4	3	9
Informal placement	4	0	2	6
Other	3	4	3	10
No placement service	16	2	13	31

Location of jobs received by students. By far, most of the jobs obtained by the students are in local businesses (remembering that, for the most part, the interviews in the schools in this study were conducted in urban or industrial areas), with 115 of 154 schools responding to this question indicating local placement of students (Table 13-20). Twenty-five of the schools said their students receive jobs in nearby large cities; and a few said their students find employment all over the country.

Problems in placing students. Considerably over half the schools expressed no particular problem in placing their data processing students in jobs, although 23 did say that the demand for their students was greater than the supply of students available for placement (Table 13-21). Sixteen schools stated that one of the major problems was that students were hired by business before they had completed their studies, and about an equal number said that business wanted only top students, making it a problem to place the poor students in this field.

Among the miscellaneous problems brought out by a few of the schools was that businesses wanted experienced people and were reluctant to hire their students because the companies felt that many of the young people would leave shortly and go on to college.

Table 13-20. Location of Jobs in Which Students are Placed

Location	High Schools N=72	Voc-Tech Schools N=32	Junior Colleges N=72	Total N=176
Locally	45	23	47	115
Nearby large cities	10	6	9	25
All over the country	2	2	3	7
Program too new, don't know	1	0	6	7

Table 13-21. Problems in Placing Data Processing Students

Problems	High Schools N=72	Voc-Tech Schools N=32	Junior Colleges N=72	Total N=176
No particular problems	31	12	38	81
Demand greater than supply	6	6	11	23
Students hired before courses completed	5	4	7	16
Placing poor students; business wants top students	6	3	6	15
Program too new	1	2	6	9
Business reluctant to hire girls	2	3	1	6
Miscellaneous problems	20	10	12	42

COURSES AND COURSE CONTENT

High Schools

Course coverage in data processing courses at the high school level in the schools included in this study is relatively limited, with the exception of a few schools. The head of the data processing departments in each of the schools was asked to examine a list of course titles to select those most closely resembling the titles of the courses offered in his school and to supply the title used in his school for the course. The course titles given by the interviewees are listed in Appendix C-5.

Compilation of the data regarding courses offered revealed that in general high school data processing is offered mainly in three courses: Introduction to Data Processing, Unit Record Systems and Equipment, and Data Processing Applications. Ten schools also reported offering a course entitled Introduction to Programming. Other courses reported by high schools in lesser numbers are shown, together with the number of schools in which they are offered, in Appendix C-5.

Concepts and topics developed. The figures in the appendix tables as well as in Tables 13-22 and 13-23 include not only the introduction of the concepts, but in addition reflect the further development of the topic in other courses; for instance, the concept of flow charting may be introduced in the introductory data processing course, further developed in a data processing applications course. The tables represent the total number of times the concepts and applications were mentioned by the school but they give no indication of whether or not the topics and applications were mentioned by the same school more than once in different courses.

Table 13-22 shows the concepts and topics incorporated in the four main courses by at least 10 of the 72 high schools. The Introduction to Data Processing course seems to be a rather broad course covering the field of data processing at least to the extent that the student might develop a "feel" for what data processing is and have some idea of the means by which data processing is done in business offices. The topics developed in this course include basically an overview of the concept of unit record systems and the functions of the machines involved in such systems. In about 30 per cent of the secondary schools such topics as flow charting, principles of data processing, card layout and design and computer equipment are covered in the introductory course. Such topics as block diagramming, number systems, coding and condensing data, computer logic, essentials of programming, and principles and theory of digital computers were discussed in an introductory course in less than 20 per cent of the secondary schools in this study.

Table 13-22. Topics and Concepts Discussed in Data Processing Courses by 10 or More Secondary Schools

Topic or Concept	Data Processing Courses			
	Intro. to D.P.	Unit Record Sys.& Equip.	Data Processing Applications	Intro. to Programming
Overview of unit record system	34	11	12	
History of data processing	34		13	
Functions of key punch	30	16	14	
Functions of sorter	30	16	14	
Functions of accounting machine	30	17	14	
Functions of collator	29	13	15	
Functions of reproducer	29	16	14	
Card layout and design	29	13	14	
Flow charting	23		12	
Principles of data processing	22		11	
Forms design	21	16	14	
Computer equipment	20		10	(9)
Procedures development	18		10	
Central processing unit	18			
Block diagramming	15		10	(9)
Number systems	14		11	
Purpose/functions-language	14			
Coding, condensing data	14			(9)
Computer applications	14			(9)
Computer logic	13		10	
Programming essentials	11			10
Principles & theory of digital computers	10			

Less than 20 per cent of the schools had a course which might be entitled Data Processing Applications in which several of the topics from the introductory course could be developed further. The topics included in the course called Introduction to Programming included coding and condensing data, purposes and functions of different languages, and block diagramming as well as programming essentials.

Applications and skills developed. Along with the discussions "about" data processing topics in these courses, the students in some schools were reported to have opportunity to apply their knowledges and develop certain skills (Table 13-23). Generally speaking, the applications and skills were those connected with unit record equipment, but some schools reported that students prepared flow charts, designed forms, and planned punch card layouts. (Details of the skills developed and the application of the knowledges are shown in Appendix C-6.)

Table 13-23. Skills and Knowledges Applied in Data Processing Courses by 10 or More Secondary Schools

	Data Processing Courses		
Skills and Knowledges	Introduction to Data Processing	Unit Record Sys.& Equip.	Data Processing Applications
Operate key punch	26	20	17
Plan and punch program card	22	17	16
Operate sorter	21	20	16
Operate accounting machine	20	20	15
Card layout and design	20	16	17
Wire accounting machine panel	14	18	13
Flow charting	17	10	14
Operate collator	15	14	14
Operate reproducer	16	16	15
Design forms		14	10
Wire reproducer panel	12	14	14
Wire collator panel	10	12	12

The extent to which skills are developed is shown in Table 13-24. With the exception of skill in operating the key punch and the sorter, less than half of the secondary schools interviewed in the study claimed to develop vocational level competency in operating skills on data processing equipment. Of the high schools offering experience in operating data processing equipment, the machine on which most schools claimed to develop vocational skill was the interpreter. Nearly three-fourths of the schools provided experience on the sorter and the collator; however, vocational skills are developed in only 56 and 38 of the 72 high schools, respectively. Operation of the accounting machine (tabulator) was taught in 54 of the 72 schools, of whom 63 per cent said their students were vocationally competent in operating this machine and 31.5 per cent said they provided opportunity to develop an acquaintanceship level of skill. Some programming is done in 38 out of 72 schools (52.8 per cent); and out of the 38, fifteen (35.9 per cent) claimed that their students acquire a vocational level of skill in programming.

A list of the textbooks used in the data processing courses taught in the schools surveyed is displayed in Appendix D.

Table 13-24. Operational Skills With the Degree of Proficiency Developed by Students in Secondary Schools Offering Training on Machines and in Programming

Skill	Total Schools Offering	General Knowledge About		Knowledge About Applications		Acquaintanceship		Vocational	
		N	%	N	%	N	%	N	%
Key punch simulator	28	4	14.3	0	0.0	17	60.7	7	25.0
Key punch	68	1	1.5	0	0.0	21	30.9	46	67.6
Verifier	29	6	20.7	0	0.0	6	20.7	17	58.6
Sorter	56	1	1.8	0	0.0	15	26.8	40	71.4
Reproducer	47	3	6.4	1	2.1	12	25.5	31	66.0
Collator	38	3	7.9	2	5.3	6	15.8	27	71.1
Interpreter	27	2	7.4	2	7.4	4	14.8	25	92.6
Accounting machine	54	3	5.6	0	0.0	17	31.5	34	63.0
Computer	28	1	3.6	3	11.0	10	35.7	14	50.0
Card processor	14	0	0.0	0	0.0	7	50.0	7	50.0
Tape drive	8	2	25.0	1	12.5	3	37.5	2	25.0
Data converter	3	1	33.3	0	0.0	1	33.3	1	33.3
Random access devices	11	2	18.2	0	0.0	3	27.3	6	54.5
High speed printer	17	2	11.1	1	5.9	6	35.3	8	47.0
Programming	38	4	10.5	1	2.6	8	21.0	15	39.5

Post High School Institutions

Course coverage is broader in the post high schools institutions than in the secondary schools, both in content and in number of courses (Table 13-25).

Concepts and topics developed. Whereas high school work in data processing was confined mainly to three courses, ten different courses were named by at least ten post high school institutions. Although a general introduction to data processing and a course in unit record systems and equipment were offered in junior colleges and vocational-technical schools as well as in high schools, these courses at the post high school level included more topics of a more technical nature than did courses with those titles offered at the high school level.

Other courses provided more depth in programming, systems analysis, procedures development, technical information about computers (both their functions and operation), and logic. (Details of the concepts presented are shown in Appendix C-7.)

Applications and skills. The junior college and vocational-technical students seemed to have more opportunity than did high school students to apply knowledges and develop skills in various aspects of data processing (Table 13-26). Aspects of systems analysis are carried out in several courses at the post high school level and more work is done in programming and related activities than at the high school level.

The degree of proficiency attained by the post high school students in the operation of certain machines and in programming is shown in Table 13-27. All the vocational-technical schools and junior colleges develop some degree of skill in both key punch and on the sorter, and nearly all of them on the accounting machine. However, more post high school than secondary schools claimed to develop only general knowledge about the operation of these machines or a knowledge about the applications of them in business, with fewer of them developing vocational skill than at the high school level. About the same proportion of schools at both levels reported developing vocational competency in the operation of the accounting machines, but more high schools than post high schools gave only general knowledge of the accounting machine.

Relatively more post secondary schools develop a vocational level of skill in programming than do high schools, with 90 out of 104 junior colleges and vocational-technical schools (86.5 per cent) developing programming skill compared with 52.8 per cent of the high schools. Of the high schools, only 15 (20.8 per cent) claimed to develop vocational competency in programming, while 71 (68.3 per cent) of the post high school institutions claim their students attain vocational competency in programming in their courses.

A smaller proportion of the post high school institutions developed vocational skill in computer operation than in programming. Also about 60 to 65 per cent of these institutions develop skills in operating unit record equipment to a level of vocational competency. The proportions at the high school level are slightly higher (Table 13-24).

Table 13-25. Topics and Concepts Included in Data Processing Courses in 10 or More Post Secondary Schools

Topics and Concepts	Data Processing Courses									
	Intro. to D. P.	Unit Record Sys.& Equip.	Intro. to Comp.Prog.	Intro. to Dig. Comp.	Intro. to Sys. Anal.	Advanced Prog.	D. P. Math	D. P. Sys.	Prog. Sys.	D. P. Appli.
History of data processing	76	20								
Principles of data processing	70	19	13	11						
Overview of unit record system	59	38								
Functions of key punch	57	54								
Functions of sorter	55	55								
Functions of collator	52	58								
Functions of reproducer	50	58								
Card layout and design	50	41	11		10					
Functions of accounting	48	58								
Computer equipment	46		30	21	30	10				
Central processing unit	42		29	28						
Flow charting	40	29	33	12	15					

Table 13-25 (continued)

	Data Processing Courses									
Topics and Concepts	Intro. to D. P.	Unit Record Sys.& Equip.	Intro. to Comp.Prog.	Intro. to Dig. Comp.	Intro. to Sys. Anal.	Advanced Prog.	D. P. Math	D. P. Sys.	Prog. Sys.	D. P. Appli.
Principles and theory-digital computers	36		26	25						
Block diagramming	36	11	43	14	11	11				
Number systems	35		17	14			27			
Purposes/functions-language	32		33	16		19				
Computer logic	31		36	20		10	10			
Forms design	26	35	10		16			13		
Computer applications	26		31			19		14	17	22
Registers	25		38	24		12				
Coding and condensing data	23	16	32		11	10		15		
Procedures development	23	18	12		22			17		
Programming essentials	22		56	13		19				
Uses of symbolic language	22		49	14		14				

Table 13-25 (continued)

Topics and Concepts	Data Processing Courses									
	Intro. to D. P.	Unit Record Sys.& Equip.	Intro. to Comp.Prog.	Intro. to Dig. Comp.	Intro. to Sys. Anal.	Advanced Prog.	D. P. Math	D. P. Sys.	Prog. Sys.	D. P. Appli.
Evaluation of auxiliary equipment	18		12					16		
Logic	17		15				27			
Boolean Algebra	14						39			
Programming systems	11		31			17		18	20	
Assembly programming and compiler	11		47	11		21				
Macro-generators			26			31			12	
Report generators			26			27			14	
Data scheduling systems					10	11		12	11	
Monitors and high level languages			12			39			23	
Analysis-information systems					16	11		13	12	
Fixed and floating points			28	10		18	16			

Table 13-26. Skills Developed and Knowledges Applied in Data Processing Courses in 10 or More Post High School Institutions

Skills and Knowledges	Data Processing Courses								
	Intro. to D. P.	Unit Record Sys.& Equip.	Intro. to Comp.Prog.	Intro. to Dig. Comp.	Intro. to Sys. Anal.	Advanced Prog.	D. P. Sys.	Prog. Sys.	D. P. Appli.
Operate key punch	25	64	10						
Operate sorter	22	66							
Operate collator	17	62							
Operate reproducer	16	64							
Operate accounting machine	17	63							
Wire collator panel	11	60							
Wire reproducer panel	12	61							
Wire accounting machine panel	13	67							
Plan and punch program card	28	54							
Card layout and design	27	48	11		11				
Design forms		29	11		21		14		
Flow charting	21	25	36	12	14	12	10		
Work load evaluation		15			17		14		
Coding, condensing data	20	19	30	13	11	11	10		
Block diagramming	17		49	17	10	12	10		

Table 13-26 (continued)

Skills and Knowledges	Data Processing Courses								
	Intro. to D. P.	Unit Record Sys.& Equip.	Intro. to Comp.Prog.	Intro. to Dig. Comp.	Intro. to Sys. Anal.	Advanced Prog.	D. P. Sys.	Prog. Sys.	D. P. Appli.
Operate computer	12		62	17		23			
Program instructions	10		52			21			
Machine language	11		62	14		13			
Autocoder			30			25			
Fortran			26			38		12	
Cobol			13			36		17	
Other languages			22			22		13	
Maintaining program library			15			22		12	
Maintaining magnetic tape library			11			14		11	
Operate card processor			34	10		16			
Computer applications			35			14	10	11	21
Loops and indexing			56	13		36			
Subroutines			52	11		40		11	
I/O controls			50	10		33		12	
Programming a tape system			20			31		10	

Table 13-26 (continued)

Skills and Knowledges	Data Processing Courses								
	Intro. to D. P.	Unit Record Sys.& Equip.	Intro. to Comp.Prog.	Intro. to Dig. Comp.	Intro. to Sys. Anal.	Advanced Prog.	D. P. Sys.	Prog. Sys.	D. P. Appli.
Job timing			17			21			
Programming random access devices			21			45		10	
Debug programs			63	12		38		17	
Sort-merge programming			18			38		19	

Table 13-27. Operational Skills With the Degree of Proficiency Developed by Students in Post Secondary Schools Offering Training on Machines and in Programming

Skill	Total Schools Offering	General Knowledge About		Knowledge About Applications		Acquaintanceship		Vocational	
		N	%	N	%	N	%	N	%
Key punch simulator	19	2	10.5	2	10.5	10	52.6	5	26.3
Key punch	104	11	10.6	8	7.7	39	37.5	46	44.2
Verifier	77	16	20.8	10	13.0	19	24.7	32	41.6
Sorter	104	10	9.6	8	7.7	19	18.2	67	64.4
Reproducer	93	11	11.8	9	9.7	16	17.2	57	61.3
Collator	87	11	12.6	9	10.3	12	13.8	55	63.2
Interpreter	89	13	14.6	12	13.5	13	14.6	51	57.3
Accounting machine	99	11	11.1	7	7.1	18	18.2	63	63.6
Computer	92	7	7.6	8	8.7	13	14.1	64	69.6
Card processor	50	7	14.0	5	10.0	6	12.0	32	64.0
Tape drive	49	12	24.5	13	26.5	3	6.1	21	42.8
Data converter	30	12	40.0	9	30.0	1	3.3	8	26.7
Random access devices	66	11	16.7	8	12.1	6	9.1	41	62.1
High speed printer	73	8	11.0	8	11.0	8	11.0	49	67.1
Programming	90	6	6.7	4	4.4	9	10.0	71	78.9

Cooperative Part-time Work Experience Programs

Training students in data processing through a cooperative work experience program is not a common practice, with only 50 of the 176 schools reporting such a program (Table 13-28). Over half the high schools in the study reported having work experience programs in office occupations, but a little over 30 per cent of them offer work experience in data processing. A greater proportion of vocational-technical schools have work experience programs in data processing than do either high schools or junior colleges. Only about a fifth of the junior colleges provide on-the-job work experience for their data processing students.

These cooperative work experience programs are coordinated most frequently by the office occupations coordinator, especially in the high schools (Table 13-29). No trend is apparent as to who coordinates the program in the vocational-technical schools, but in the junior colleges about a third of the programs were coordinated by the data processing instructor. At one of the junior colleges, the work experience program was coordinated by a distributive education coordinator. Data processing instructors or the department head did the coordinating in eight of the junior colleges. In seven of these schools a special data processing coordinator performs this function.

Certain prerequisites are set up for entry into the cooperative part-time training programs in data processing, including course grades, interest of the students, and the students' skills and abilities. The most common criterion for the selection of students is the students' over-all course grades (Table 13-30), followed in frequency by the grades achieved in data processing courses and interest in such a program. None of the schools mentioned business courses as prerequisites.

In more programs than not, the students are required to have operational skills before they are placed in their work stations, or at least they are required to have beginning vocational skill (Table 13-31). Apparently the schools require no set amount of time to be spent on the job, since the most frequent answer to this inquiry was either "No set amount" or "As much as possible" (Table 13-32).

In general, data processing students seem to be relatively easy to place in work stations, since 28 out of 41 schools reported that their students were as easily or more easily placed on the job than are general office occupations students (Table 13-33). High schools reported in greater proportion than the other schools that data processing students are more difficult to place on the job than are office occupations students. The junior colleges, on the other hand, report that data processing students are easier to place than the office students.

Table 13-28. Cooperative Part-Time Programs

Type	High Schools N=72		Voc-Tech Schools N=32		Junior Colleges N=72		Total N=176	
	N	%	N	%	N	%	N	%
General office	39	54.2	9	28.1	20	27.7	68	38.6
Data processing	23	31.9	12	37.5	15	20.8	50	28.4

Table 13-29. Coordinator for Cooperative Students in Data Processing

Coordinator	High Schools	Voc-Tech Schools	Junior Colleges	Total
Office occupations	10	1	0	13
Special data processing	2	2	3	7
Diversified occupations	0	1	2	3
Data processing instructors	2	2	4	8
Department head or supervisor	3	3	2	8
Distributive education	2	0	1	3
Vocational education	3	2	1	6
Other	1	1	2	4

Table 13-30. Bases for Selection of Students for Work Experience Programs

Basis for Selection	High Schools	Voc-Tech Schools	Junior Colleges	Total
Business course grades	3	1	0	4
Overall course grades	8	2	3	13
Data processing course grades	6	2	0	8
Special tests	2	0	0	2
Interested students	5	2	0	7
Students' Skill and ability	2	2	1	5
Other	2	2	4	8

Table 13-31. Level of Skill Required for Placement in Work Stations in Cooperative Work Experience Programs

Level of Skill	High Schools	Voc-Tech Schools	Junior Colleges	Total
Acquaintance	4	0	3	7
Beginning vocational skill	3	4	4	11
Good operational skill	7	5	5	17
Other	9	3	3	15

Table 13-32. Amount of On-the-Job Training Required of Cooperative Students

Amount	High Schools	Voc-Tech Schools	Junior Colleges	Total
No set amount	3	4	5	12
As many weeks as possible	17	1	3	21
6 weeks	0	0	2	2
1 semester	3	1	1	5
2 years	0	0	1	1

Table 13-33. Placement of Data Processing Students in Work Stations Compared with Office Occupations Students (Degree of Placement Ease)

Degree	High Schools	Voc-Tech Schools	Junior Colleges	Total
More easily placed	4	5	7	16
As easily placed	5	2	5	12
Not as easily placed	9	1	3	13

EQUIPMENT

The data processing equipment reported in the secondary schools tended to be unit record equipment, including key punches reported by 97 per cent of the schools; sorter, 80.6 per cent; accounting machines, 69.4; reproducer, 58.3 per cent; and collator, 54.2 per cent (Table 13-34). Verifiers and interpreters were reported by between 30 and 40 per cent of the schools.

One-third of the high schools included in the study reported having a computer available for instruction, and these schools had 24 computers available for instructional use (Table 13-34). However, other peripheral equipment was found to a lesser extent in the secondary schools than were computers, with about one-sixth of the schools having a printer available and about one-seventh of the schools with some random access device available. Card processors were reported in nine out of the 72 high schools. The amount of equipment available for use in the schools surveyed compared favorably with the available equipment reported in all the schools as a result of the national survey of secondary and two-year post high schools (see Appendix C, Table C-8).

Acquisition of Equipment

The equipment used by the high schools is, generally speaking, purchased outright, rented, or leased (Table 13-34). About 70 per cent of the schools reported renting or leasing key punches, but 22 out of the 72 schools reported owning key punch machines. The other equipment is owned, rented, or leased in about the same proportions as are key punches. Of the schools that have computers available, however, ten reported having purchased them (41.7 per cent) and 13 schools rent or lease them. One school reported that their students were permitted to use a computer in a business office downtown.

A greater proportion of post high school institutions have equipment available for instruction in data processing than do high schools, especially computers and peripheral equipment. While one-third of the high schools reported having a computer available, over 80 per cent of the post high school institutions indicated the availability of computers for instruction. More of the post secondary schools than high schools reported having peripheral equipment also. More than 40 per cent of them, for instance, reported having some random access devices, while about 14 per cent of the high schools indicated having such equipment; and nearly half the post high school institutions have printers, but only about one-sixth of the high schools have printers available for training.

Table 13-34. Data Processing Equipment Available for Post High School and High School Student Use

Equipment	Ownership or Location of Equipment Used							
	Gift	Purchase	Lease	Rent	Use Equip Admin Off	Use Equip in Downtown Off	Total Schools with Equip	Percent*
Key punch simulator								
Post high school	0	11	2	0	0	1	14	13.5
High school	0	23	1	1	0	0	25	34.9
Key punch								
Post high school	1	37	35	23	0	3	99	95.2
High school	3	22	24	20	1	0	70	97.2
Verifier								
Post high school	1	22	24	8	0	3	58	55.8
High school	3	8	7	10	0	0	28	38.9
Sorter								
Post high school	2	36	32	16	0	2	88	79.8
High school	2	18	21	15	2	0	58	80.6
Reproducer								
Post high school	1	27	28	14	0	2	72	61.5
High school	2	11	17	10	1	1	42	58.3

*The percentages are based on 104 post high school institutions and 72 secondary schools.

Table 13-34 (continued)

Equipment	Ownership or Location of Equipment Used							
	Gift	Purchase	Lease	Rent	Use Equip Admin Off	Use Equip in Downtown Off	Total Schools with Equip	Percent*
Collator								
Post high school	1	28	28	13	0	3	73	70.2
High school	2	14	13	8	2	0	39	54.2
Interpreter								
Post high school	1	23	24	14	0	2	64	69.2
High school	1	9	10	6	1	0	27	37.5
Accounting machine								
Post high school	3	37	27	14	0	2	83	84.6
High school	2	15	17	14	1	1	50	69.4
Computer								
Post high school	3	28	31	16	0	6	84	80.8
High school	0	10	7	6	0	1	24	33.3
Card processor								
Post high school	2	11	14	6	0	3	36	34.6
High school	0	4	3	2	0	0	9	12.5

*The percentages are based on 104 post high school institutions and 72 secondary schools.

Table 13-34 (continued)

Equipment	Ownership or Location of Equipment Used							
	Gift	Purchase	Lease	Rent	Use Equip Admin Off	Use Equip in Downtown Off	Total Schools with Equip	Percent*
Tape drive								
Post high school	1	5	6	5	0	4	21	20.2
High school	0	1	2	1	0	0	4	5.6
Data converter								
Post high school	2	2	2	1	0	2	9	8.6
High school	0	0	0	1	0	0	1	1.4
Random access devices								
Post high school	1	12	20	8	1	2	44	42.3
High school	0	4	4	2	0	0	10	13.9
High-speed printer								
Post high school	1	9	26	10	1	3	50	48.1
High school	0	3	5	4	0	0	12	16.7

*The percentages are based on 104 post high school institutions and 72 secondary schools.

More of the post high school institutions reported renting or leasing their data processing equipment than owning it, although a slightly greater proportion of them reported purchase of their equipment compared with the secondary schools. About three-eighths of the post secondary schools own their unit record equipment, while about 30 per cent of the high schools do. One-third of the post high school institutions own their computers; but a smaller proportion of them own peripheral equipment, with about 27 per cent reporting ownership of random access devices and 18 per cent owning a printer.

Three of the post high school institutions reported that business had donated a computer to them.

High schools tend to have slightly more unit record equipment per school than do the other schools (Table 13-35). They also make more use of key punch simulators, with an average of about six simulators per school compared with two and a half simulators in each of the post high school institutions. The high schools also have one more key punch per school than do the other schools. On the other hand, the junior colleges and vocational-technical schools have more computers and peripheral equipment.

Source of Funds for Equipment and Supplies

Four main sources of funds for equipment and supplies were reported by the schools in this study; namely, under provisions of NDEA, from funds provided by the Vocational Education Act, from MDTA funds, or from state or local funds (Table 13-36). Most of the schools, 133 out of 176 reported that their equipment was financed wholly or in part by local funds and half that number (66) reported use of state funds for financing data processing equipment, wholly or in part.

Of the federal funds available for purchase of equipment for vocational training programs, the most commonly reported source is from funds provided under the Vocational Education Act, through which 53 of the 176 schools (about 30 per cent) obtained at least some of the necessary equipment. Thirteen of the schools (seven of those 13 were high schools) reported getting as much as 91 per cent of their funds from this source. Most of the schools (35) reporting use of Vocational Education Act funds said they received from 26 to 50 per cent of their money for equipment through this act.

Table 13-35. Data Processing Equipment for Instruction at Beginning of Program and Equipment Added Later

Equipment	High School						Post High School					
	Beginning		Added		Total		Beginning		Added		Total	
	Sch.	Mach.	Sch.	Mach.	Mach.	%	Sch.	Mach.	Sch.	Mach.	Sch.	Mach.
Key punch simulator	25	318	16	121	439	6.1	9	73	14	187	260	2.5
Key punch	61	288	28	108	396	5.5	80	253	51	207	460	4.4
Verifier	20	36	8	10	46	.6	43	85	17	25	110	1.0
Sorter	46	57	16	22	79	1.1	71	75	25	28	103	1.0
Reproducer	36	41	11	15	56	.8	54	55	21	21	76	.7
Interpreter	23	27	5	23	50	.7	41	41	23	24	65	.6
Collator	32	40	10	14	54	.75	49	49	23	23	72	.7
Accounting machines	43	66	13	21	87	1.2	67	69	21	22	91	.9
Computer	17	18	14	16	34	.5	46	49	33	36	85	.8
Card processor	8	8	3	3	11	.2	20	21	13	14	35	.3
Tape drive	5	27	3	10	37	.5	6	12	14	36	48	.5
Random access devices	5	6	7	22	28	.4	16	19	28	41	60	.6
Printer	8	8	8	9	17	.2	20	22	35	39	61	.6
Data converter	2	1			3		1	1	4	4	5	

Table 13-36. Sources of Funds for Data Processing Equipment in Schools

Source	% of Source	High Schools	Voc-Tech Schools	Junior Colleges	Total
NDEA	0-25	2	1	1	4
	26-50	3	2	12	17
	51-75	3	0	1	4
	76-90	1	0	0	1
	91-100	0	1	0	1
Totals		9	4	14	27
Voc. Ed. Act	0-25	2	1	0	3
	26-50	14	8	13	35
	51-75	0	0	1	1
	76-90	1	0	0	1
	91-100	7	4	2	13
Totals		24	13	16	53
MDTA	0-25	0	1	0	1
	26-50	1	1	1	3
	51-75	0	0	0	0
	76-90	0	1	0	1
	91-100	1	1	0	2
Totals		2	4	1	7
State Funds	0-25	2	2	2	6
	26-50	17	8	18	43
	51-75	1	2	6	9
	76-90 and 91-100	2	2	4	8
Totals		22	14	30	66
Local Funds	0-25	3	4	6	13
	26-50	27	7	30	64
	51-75	4	1	6	11
	75-90 and 91-100	16	1	23	40
Totals		50	13	65	128

The purchase of supplies also is mainly financed through local funds (Table 13-37), with 117 schools reporting that all or part of their funds for supplies come from local sources; and 50 receive state funds for the purchase of supplies. Although over 50 schools received funds under the Vocational Education Act for equipment, only 25 reported using such funds for supplies. High schools tended more frequently to report state and local funds being used for purchase of supplies than did the other types of schools. On the other hand, junior colleges reported in greater proportion having received VEA funds for supplies than did the high schools. Supplies were purchased with student fees in 27 of the schools; and MDTA was the source of funds for supplies in only four of the schools, with three out of the four being vocational-technical schools.

Sources of Equipment

Less than half (44.3 per cent) of the schools reported owning data processing equipment, excluding computers (Table 13-38). Out of 78 schools reporting that they own data processing equipment (as opposed to leasing or "borrowing" it), 50 of them reported buying the equipment new from a manufacturer and 15 of the schools had obtained used equipment from a manufacturer.

Less than a third of the schools (31.2 per cent) own computers (Table 13-39). Over half the vocational-technical schools own a computer compared with 29.2 per cent of the junior colleges and 20.8 per cent of the high schools. Of the schools that have purchased computers, two-thirds of the high school computers were purchased new from the manufacturer; over three-fourths of the vocational-technical schools and about one-fifth of the junior colleges obtained new computers. One-fifth of the 54 computers reported had been purchased as used equipment, either from the manufacturer or from a used machine dealer. One high school reported that its computer was donated to the school by a business.

Location of the Equipment

The equipment with which the students work tended to be in the school in which the students were located, except in the high schools (Table 13-40). The schools in which interviews took place in this study were mostly in larger metropolitan areas, with each school district containing more than one high school. Forty out of the 66 high school districts reporting owning data processing equipment reported that it was centralized in a single school. A few junior colleges and vocational-technical schools reported having equipment in more than one location; but most of them reported that if the school district was comprised of more than one school, the equipment tended to be centralized in one building.

On the other hand, regarding computers owned by the high schools, 13 of the 23 were in the schools' own data processing departments (Table 13-41). In only two vocational-technical and nine out of 44 junior colleges either the students or the data were transported to a computer away from the school.

Table 13-37. Source of Funds for Data Processing Supplies

Source	% of Source	High Schools	Voc-Tech Schools	Junior Colleges	Total
Voc. Ed. Act.	0-25	0	1	0	1
	26-50	5	2	9	16
	51-75	0	0	2	2
	76-100	3	1	2	6
Totals		8	4	13	25
MDTA	0-25	0	1	0	1
	26-50	1	1	0	2
	51-75	0	0	0	0
	76-100	0	1	0	1
Totals		1	3	0	4
State Funds	0-25	2	0	2	4
	26-50	10	5	12	27
	51-76	2	2	5	9
	76-100	2	3	5	10
Totals		16	10	24	50
Local Funds	0-25	1	3	5	9
	26-50	18	2	22	42
	51-75	2	1	2	5
	76-100	33	8	20	61
Totals		54	14	49	117
Student Fees	0-25	0	1	1	2
	26-50	1	4	6	11
	51-75	0	0	2	2
	76-100	4	6	2	12
Totals		5	11	11	27

Table 13-38. Source of Purchase of Data Processing Equipment, Except Computer

Source	High Schools	Voc-Tech Schools	Junior Colleges
Government surplus	0	1	0
Used from manufacturer	3	7	5
New from manufacturer	20	15	15
Used machines from dealer	0	1	3
New machines from dealer	2	2	0
DPMA	2	1	0
Donated by business	1	0	0
Totals	28	27	23

Table 13-39. Source of Computer (Purchase)

Source	High Schools	Voc-Tech Schools	Junior Colleges
Government surplus	1	1	2
Used from manufacturer	3	3	3
New from manufacturer	10	14	15
Used machine from dealer	0	0	1
Donated by business	1	0	0
Totals	15	18	21

Table 13-40. Location of Data Processing Equipment, Except Computer

Location	High Schools	Voc-Tech Schools	Junior Colleges
In centralized school	40	27	58
In each school	16	4	4
In administrative offices	6	0	4
In business/government offices	2	1	3
In adult vocational center	1	0	0
Other	1	0	1

Table 13-41. Location of Computer

Location	High Schools	Voc-Tech Schools	Junior Colleges
In own department	13	22	35
Outside of school			
Transport student	8	1	6
Transport data	2	1	3

Maintenance of Equipment

Most of the schools reported that repairs and service of their equipment is done under terms of service contracts (Table 13-42). Only about one-third of the schools reported not having service contracts, and the proportion is about the same for all kinds of equipment.

Table 13-42. Data Processing Equipment Maintenance

Equipment	High School		Post High School	
	On Call	Service Contract	On Call	Service Contract
Key punch simulator	8	10	4	5
Key punch	16	43	20	60
Verifier	8	17	11	39
Accounting (Tab) Machines	13	32	18	50
Interpreter	6	20	10	41
Collator	13	22	14	46
Reproducer	9	27	13	45
Sorter	13	35	15	53
Computer	3	18	10	51
Card processor	3	3	6	23
Tape drive	1	3	3	10
Data converter	1	0	0	4
Random access devices	4	6	3	31
Printer	3	8	4	35

STAFFING DATA PROCESSING INSTRUCTIONAL DEPARTMENTS

Out of the 176 schools which supplied information for this investigation, 159 reported having full-time teachers in data processing (Table 13-43). All of the vocational-technical institutions reported full-time teachers, but 62 out of 72 high schools and 66 out of 72 junior colleges reported having full-time teachers in data processing.

Table 13-43. Full-Time and Part-Time Data Processing Teachers in High Schools and Post High Schools Offering Data Processing

Teachers	High Schools N=72	Voc-Tech Schools N=31	Junior Colleges N=72	Total N=175
Full-time teachers				
Number of schools	62	31	66	159
Number of teachers	172	94	165	431
Mean no. of teachers	2.77	3.0	2.5	
Part-time teachers				
Number of schools	30	22	66	117
Number of teachers	91	79	321	491
Mean no. of teachers	3.0	3.6	4.9	

The same number of junior colleges reported employing part-time instructors in data processing as reported full-time teachers; namely, 66. However, less than half the high schools employ part-time data processing teachers, and about two-thirds of the vocational-technical schools have part-time instructors.

Size of Staff

Table 13-43 also shows that although the mean number of full-time data processing teachers in junior colleges is smaller than in either of the other two kinds of institutions, the junior colleges have a higher average number of part-time instructors, with the 66 junior colleges averaging about five part-time instructors each. This compares with about three and 3.5 part-time instructors in the high schools and vocational schools, respectively.

Of the 62 high schools employing full-time data processing teachers, 12 reported more than four full-time data processing instructors, with one school having as many as 13 data processing teachers (Table 13-44). In 24 out of the 62 high schools only one data processing teacher was employed. Thirty-one of the 32 vocational-technical institutions have full-time teachers; six of the 31 vocational-technical institutions have only one full-time data processing instructor. One vocational school reported 12 full-time data processing teachers. Junior colleges, however, hire a greater number of part-time teachers than do high schools or vocational schools. Four junior colleges reported employing 13 or more part-time instructors.

Teaching Assignments

Table 13-45 shows that the part-time instructors are employed mainly in evening classes, with only 16 schools reporting the use of data processing employees from business firms as daytime instructors.

The courses most frequently taught by part-time personnel from business data processing departments are programming, key punch, unit record systems, and board wiring (Table 13-46). Programming ranked either first or second in frequency of mention by all three kinds of schools employing business personnel as instructors. Key punch was the course most frequently taught by data processing employees from business in both high schools and in vocational schools. In vocational schools, unit record systems held a rank equal to that of key punch, however. In nearly half the high schools in which business personnel taught courses, programming was taught by these people. This was also true of the vocational schools.

Qualifications required of part-time teachers. In evaluating qualifications of people to hire as part-time instructors in data processing, the most frequently mentioned background was that of work experience in data processing, either in a business or government office (Table 13-47). This was true in all three kinds of schools. In fact, work experience was listed as a requirement for part-time teaching almost three times as often as teaching experience. Part-time teachers in a large number of schools need a college degree, although not necessarily a graduate degree, even for teaching in junior college programs. Of the courses these people should have studied, data processing and business courses were most frequently mentioned, with mathematics being the next most frequently listed course requirement. In only ten of the 117 schools hiring part-time teachers was state certification a requirement for employment of part-time teachers.

Table 13-44. Number of Full-Time and Part-Time Data Processing Teachers

No. of Teachers	Full-Time Teachers			Part-Time Teachers		
	High Schools N=72	Voc-Tech Schools N=32	Junior Colleges N=72	High Schools N=72	Voc-Tech Schools N=32	Junior Colleges N=72
1	24	6	15	14	3	8
2	14	9	31	2	7	12
3	8	7	9	8	2	12
4	4	5	3	3	6	11
5	4	1	4	1	1	4
6	4	2	1	0	1	5
7	2	0	1	0	0	4
8	0	0	2	0	0	3
9	1	0	0	0	1	0
10	0	0	0	1	0	1
11	0	0	0	0	0	2
12	0	1	0	0	1	0
13 or more	1	0	0	1	0	4
Totals	62	31	66	30	22	66

Table 13-45. Day and Night Data Processing Classes Instructed by Employees from Business

Classes	High Schools N-72	Voc-Tech Schools N=32	Junior Colleges N=72	Total N=176
Day	4	4	8	16
Night	22	24	61	103

Table 13-46. Courses Taught by Part-Time Personnel from Business

Courses	High Schools	Voc-Tech Schools	Junior Colleges	Total
Key punch	17 (1)*	14 (1)	16 (4)	47 (2)
Unit record (except machine accounting)	8	11 (3)	13	32
Accounting machine wiring	12 (3)	12 (2)	18 (3)	42 (4)
Unit record systems	10 (4)	14 (1)	20 (2)	44 (3)
Computer theory and logic	7	8	12	27
Systems analysis	4	5	13	22
Programming	14 (2)	12 (2)	28 (1)	54 (1)
Program systems	3	5	11	19
Computer operation	5	9	11	25
Data processing applications	4	7	11	22
Data processing math	3	2	6	11
Data processing systems	4	3	11	18
Introduction to data processing	7	4	15	26

*The numbers in parentheses represent the rank by frequency of mention.

Table 13-47. Preparation Background and Experience of Part-Time Data Processing Teachers

Preparation and Experience	High Schools	Voc-Tech Schools	Junior Colleges	Total
Education				
High school	4	4	1	9
Business or trade schools	4	2	1	7
Some college	2	1	2	5
Bachelor's degree	13	5	33	51
Graduate degree	0	2	11	13
Background courses				
Business	7	5	17	29
Data processing courses	13	8	14	35
Mathematics	6	4	11	21
Science	2	2	4	8
Psychology	0	0	2	2
Psychology of learning	0	0	0	0
Other	2	1	2	5
State certification	6	1	3	10
Experience				
Teaching	8	3	25	36
Business or government data processing	24	21	60	105
Miscellaneous	0	0	2	2

CHAPTER XIV

DATA PROCESSING TEACHERS

Teachers were asked to fill out a questionnaire regarding their education and work experience backgrounds in order to get an indication of the type of people who are now teaching in the data processing field to see how they acquired the background to teach data processing.

EDUCATION

A total of 475 teachers filled out questionnaires, of whom 279 (58.7 per cent) were teaching at the high school level, and 196 (41.3 per cent) were in the secondary schools (Table 14-1).

Table 14-1. Education of High School and Post High School Data Processing Teachers

Education	High School	Voc-Tech Junior College	Total
High school or less	6	15	21
Private business school	4	10	14
Public voc-tech school	5	8	13
One or two years college	9	16	25
Two years college (no degree)	3	19	22
College degree	169	211	380
Totals	196	279	475

5

Degrees

A greater proportion of the secondary school teachers held degrees than did the post high school teachers, 86.2 per cent and 75.6 per cent, respectively. In many states, however, certification laws are more rigid for the secondary schools than they are for junior colleges, which may account for the higher percentage of degrees among the high school teachers.

The same proportion of people teaching at both the secondary and the post high school levels (81 per cent) have had education beyond the bachelor's degree, about half of whom have completed at least a master's degree (Table 14-2). Also, the proportion of teachers who hold advanced degrees is very nearly equal among the teachers at both educational levels.

Table 14-2. Levels of College Work Completed by High School and Post High School Data Processing Teachers

Levels	High School	Voc-Tech Junior College	Total
Bachelor's degree only	32	40	72
Graduate work, but no advanced degree	59	69	128
Master's degree	26	37	63
Work beyond master's, but not a doctorate	50	63	113
Doctorate	2	2	4
Totals	169	211	380

Areas of Study in College

A greater proportion of the high school teachers with at least a bachelor's degree (60.9 per cent) declared business or business education as a major than did teachers at the post secondary level, of whom 53.7 per cent had business or business education majors (Table 14-3). Mathematics and science account for over 21 per cent of the majors completed by the post high school teachers

Table 14-3. Bachelor's Degree Majors of High School and Post High School Data Processing Teachers

Major	High School	Voc-Tech Junior College	Total
Business	58	85	143
Business education	45	23	68
Mathematics	19	31	50
Science	4	12	16
Engineering	2	12	14
Education	1	5	6
More than one major	18	16	34
Other	11	17	28
No response	11	10	21
Totals	169	211	380

and by less than 14 per cent of the high school teachers of data processing.

The major areas of interest seemed to shift somewhat for teachers teaching at both levels of education in their graduate work. (Table 14-4). Of the people who responded to the inquiry about their area of study at the graduate level, 22 per cent declared education as their field. This may be because in many graduate schools the major is declared in education with a field of specialization within it in business education. The proportion who were in business or business education remained about the same. However, the number of teachers who continued study in mathematics at the graduate level decreased some. The figures for graduate study, however, are based only on those who actually responded to this question. Apparently some question existed regarding this inquiry since only 149 out of a possible 308 junior college technical school people answered this question.

Table 14-4. Field of Graduate Study of High School and Post High School Data Processing Teachers

Field	High School	Voc-Tech Junior College	Total
Business	15	49	64
Business education	41	23	64
Mathematics	4	19	23
Science	4	3	7
Engineering	3	5	8
Education	34	26	60
Other	13	20	33
More than one major	8	4	12
Totals	122	149	271

SOURCES OF DATA PROCESSING BACKGROUND

Data processing teachers have received their background in data processing in several different ways. Some have had courses in summer school sessions, in manufacturers' schools or in special workshops for teachers. Others have developed their background further by doing data processing work in business offices or in the military.

Schools Attended

Over half the data processing teachers had acquired at least some of their data processing background by attending manufacturers' schools, 272 out of 475 teachers, and 229 (48.3 per cent) of the teachers had had work experience in business (Table 14-5).

Table 14-5. Source of Data Processing Background of High School and Post High School Data Processing Teachers

	High School N=196		Post High School N=279		Total N=475	
Source	No.	%*	No.	%	No.	%
Attended manufacturer's school	90	45.9	182	65.2	272	57.2
College classes	81	41.3	120	43.0	201	42.3
Attended data processing workshops	71	36.2	60	21.5	131	27.6
Worked in data processing department	67	34.2	162	58.0	229	48.2
Attended night classes	33	16.8	42	15.1	75	15.8
Self-study with programmed textbooks	70	35.7	112	40.1	182	38.3
On-the-job training	62	31.6	127	45.5	189	39.8
Military	16	8.2	30	10.8	46	9.7
Other	14	7.1	28	10.0	42	8.8

*Percentages add to more than 100% because each teacher could make more than one response to the question.

However, this was true for more of the post high school teachers than for the secondary schools. Nearly two-thirds of the post secondary teachers had attended manufacturers' schools, while only slightly over 45 per cent of the high school teachers had done so. Perhaps this is because the most popular high school course is instruction in key punch operation, and more sources of instruction are available on this machine than on the other more advanced machines which are taught in the post high school institutions.

More than half again as many post high school teachers had had work experience than had high school teachers, 58 and 34 per cent, respectively (Table 14-5). Also, more of the post secondary teachers reported having had on-the-job training (45.5 per cent) than high school teachers (31.6 per cent) and a slightly greater percentage of the junior college and vocational-technical school teachers had used programmed textbooks on their own (40.1 per cent) than high school teachers (35 per cent).

Data Processing Work Experience

Over all, many data processing teachers have had some actual work experience in the field of data processing, with 60 per cent of them reporting at least one year of employment in data processing, and one-fifth of them having worked in data processing more than 8 years (Table 14-6).

Table 14-6. Amount of Teachers' Work Experience in Data Processing

	High School N=196		Post High School N=279		Total N=475	
Amount of Experience	No.	%	No.	%	No.	%
No experience	95	48.5	54	19.4	149	31.4
1- 6 months	15	7.7	10	3.6	25	5.3
6-12 months	6	3.1	11	3.9	17	3.6
12-18 months	5	2.6	5	1.8	10	2.1
18-24 months	7	3.6	14	5.0	21	4.4
2 years	14	7.1	24	8.6	38	8.0
3 years	11	5.6	21	7.5	32	6.7
4 years	5	2.5	26	9.3	31	6.5
5 years	5	2.5	21	7.5	26	5.5
5- 8 years	5	2.5	24	8.6	29	6.1
Over 8 years	28	14.3	69	24.7	97	20.4

However, among the high school teachers, only slightly over half have any work experience in data processing at all, and 60 per cent of them had not had over a year's experience. On the other hand, of the teachers in the post secondary schools, over four-fifths reported having had some data processing experience in business, and nearly three-fourths (73.1 per cent) had had over a year's experience. Nearly a fourth of the post secondary school teachers had worked in data processing eight years or more, but only 14 per cent of the high school teachers had had that amount of experience.

Kinds of firms in which teachers gained data processing experience. Data processing teachers in the main had acquired their data processing experience in accounting firms, educational institutions, or manufacturing concerns (Table 14-7). In addition, especially the post high school teachers had gained their experience in government offices. The pattern, generally speaking, was the same for both the high school and the post secondary teachers. (See Appendix A-Table 5 for activities performed by teachers in data processing departments.)

Table 14-7. Types of Business Firms in Which High School and Post High School Teachers Had Data Processing Work Experience

Types of Businesses	High School	Post High School	Total
Accounting	20	37	57
Consulting	3	15	18
Education	23	50	73
Mining petroleum	1	7	8
Government	9	28	37
Distributive	4	4	8
Insurance	8	7	15
Manufacturing	15	30	45
Public utility	1	5	6
Financial	1	3	4
Military	5	8	13
Other	4	12	16
More than two businesses	6	16	22
No response	1	4	5

Job activities performed in data processing jobs and in schools. Data processing activities performed by the teachers, both on the job and in school, during their training are shown in Table 14-8.

Table 14-8. Data Processing Activities Performed by Teachers in Businesses and in School (By Rank)

Activity	Business			School		
	High School Teachers	Voc-Tech Junior College Teachers	Total	High School Teachers	Voc-Tech Junior College Teachers	Total
Operated key punch	1	3	1	1	5	3
Operated verifier	11			10		
Operated collator and reproducer	3	4	4	5	9	9
Wired boards	5	12	8	2	4	5
Planned wiring diagrams	7		12	5	6	6
Operated sorter	2	1	2	3	9	7
Operated tab machines	4	7	5	8	8	8
Operated computer console	10	9	9	11	11	11
Wrote programs	8	5	6	5	1	1
Made block diagrams	9	6	7	9	3	4
Made flow charts	5	2	3	4	2	2
Debug programs		10	11		6	10
Run test programs	11	8	9	12	12	12
Analyzed systems		11				

The ranks of the activities to which these people had been exposed in school differs somewhat from the ranks of the duties they actually performed on the job.

The most commonly performed activity for high school teachers was that of operating the key punch machine, both in business and in school. Wiring boards was the second ranked activity for high school teachers but it was fifth in the activities performed on the job by these people. On the other hand, operating the collator and reproducer was the third most common activity on the job, but it ranked fifth in the activities they had performed in school. Rather disparate ranks were observed regarding operation of tabulating equipment, with its being ranked eighth in school activities but fourth in the activities done on the job. Other ranks were in relative agreement between job and school activities.

The post high school teachers on the other hand listed the operation of the sorter as the most frequently performed duty on the job, but it was ranked ninth in frequency of mention as an activity they had performed in school. The sorter, however, is a relatively easy machine to learn to operate, and thus its operation may not have been carried on to any extent during school training. Writing programs was the activity most often reported as a school activity by the post high school teachers, but it was the fifth most frequently mentioned duty on the job they held. Flow charting, however, was ranked second both as a job activity and as a school activity. The post high school teachers also reported wiring boards as a relatively frequently performed activity in the school, ranking it fourth, but it was ranked 12th in on-the-job activities performed by these people.

Junior college and vocational-technical school teachers apparently received different kinds of experience on the job from those of the high school teachers. The activity in business ranked first by the high school teachers was operating the key punch machine, and it is ranked third by the post high school teachers. Operating the sorter was ranked very high for both groups, and nearly the same rank is shown for the operation of the collator and reproducer by both groups. However, the second ranked activity by post high school teachers was making flow charts, but this ranked fifth among the high school teachers' activities.

Some difference in ranks of the data processing activities occurred also in the type of activities carried on in school during training. The most frequently mentioned activity of the post secondary teachers is writing programs, but this is fifth highest ranked activity of the high school teachers; making flow charts, which was ranked second by the post secondary teachers was the fourth ranked activity of the secondary school teachers. The junior college-vocational technical school teachers reported making block diagrams

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as their most frequent activity in school training, but it was ranked ninth by the high school teachers.

Several other activities listed by the teachers, but with less frequency, in both school and business include these (in rank order):

1. Operating paper-tape equipment
2. Operating data-converting equipment
3. Preparing PERT charts
4. Determining critical path
5. Designing forms for the optical scanner
6. Using random access devices
7. Operating high-speed printer.

Further details regarding frequencies of these activities are shown in Appendix A - Table 6.

Courses Studied by Data Processing Teachers

Data processing teachers have studied in many areas of data processing and have taken work in several background areas to gain greater understanding of business and its uses of data processing equipment. The data processing courses studied by the teachers tended to be mainly in the unit record area, especially among the high school teachers; while post secondary teachers concentrated more in the computer and programming areas.

Data processing courses. The courses studied most frequently by the data processing teachers were Introduction to Data Processing, Unit Record Equipment, Wiring Boards, Key Punch, and Introduction to Programming (Table 14-9). Some difference is apparent in the types of courses the two groups of teachers have studied; for example, Introduction to Computer Programming was listed with the greatest frequency by the post high school teachers (nearly 73 per cent), but it was the fifth most frequently named course by the high school teachers, of whom about 55 per cent listed this course. Although it ranked sixth among the high school teachers' courses, Introduction to Digital Computers was a course studied by only 78 (about 40 per cent) of the 196 high school teachers and by 54 per cent of the post secondary teachers.

Junior college and vocational-technical school teachers seemed to have studied more advanced courses than had high school teachers. The proportion of post high school teachers who had studied advanced programming was about twice that of the high school teachers and over twice as many of the post high school teachers had had operations research as had high school teachers. Over twice as many post high school teachers had studied data processing mathematics (35.5 per cent) as secondary school teachers (15.5 per cent).

Table 14-9. Data Processing Courses Studied by Teachers

Courses	High School	Post High School	Total
Introduction to data processing	140	198	338
Unit record equipment	124	170	294
Wiring	115	166	281
Key punch	109	135	244
Data processing applications	76	141	217
Data processing systems	65	117	182
Systems analysis	52	93	145
Introduction to systems analysis	44	81	125
Introduction to digital computers	78	153	231
Introduction to computer programming	107	205	312
Advanced computer programming	47	135	182
Computer applications	44	117	161
Operations research	17	51	68
Data processing math	30	100	130
Computer theory and logic	52	90	142
Other	11	33	44

The teachers who had had work experience showed some tendency to have studied more in the computer areas such as theory and logic of computers, programming, data processing systems, computer applications, and advanced programming than do those who had not worked in business. Perhaps this may be attributed to the fact that much of the work experience of these people has been with unit record equipment and they are now preparing more for the computer field.

Background courses. Levels at which teachers taught seemed to make some difference in the kinds of background courses teachers felt were the most helpful, both for teaching in and for understanding the data processing field. Whether or not the teacher had had work experience apparently influenced his thinking also about the usefulness of certain background courses. (See Appendix A, Table 7, for lists of courses that have been helpful to the teachers.)

Post secondary school teachers felt to a greater degree than high school teachers did that for teaching in the data processing field these courses were most helpful (Table 14-10):

1. Bookkeeping and accounting
2. Management
3. English
4. Mathematics
5. Statistics

The differences in the percentages of the secondary and post high school teachers in each instance was at least 13 per cent. The greatest divergence of opinion concerned mathematics, where 61.1 per cent of the post high school teachers felt this to be a valuable area of study, while this was the opinion of 35.2 per cent of the high school teachers, a difference of 25.6 per cent. The differences in opinion regarding bookkeeping and accounting, management, and statistics were about the same for all three areas, about 17 per cent.

On the other hand, secondary school teachers, more so than post high school teachers, felt that calculating machines and secretarial practice courses helped them in teaching data processing.

The differences were not quite so great regarding the helpfulness of background courses for understanding of data processing in general, but the same courses in general showed differences between high school and post high school teachers regarding their value.

Post high school teachers considered to even a greater extent than did high school teachers that mathematics was necessary for understanding the data processing field than they did for teaching in this field. Also, the difference between high school and post high school teachers regarding the value of science in helping to understand data processing is considerably more than the difference in opinion regarding science as background for teaching data processing. Also, considerably more of the post high school teachers felt that mathematics was essential for understanding than felt that it was necessary for teaching.

The opinions of teachers with work experience tended to be different from those who had not had work experience in this field in business. The teachers without work experience tended, more than teachers with, to consider as good background for teaching such courses as bookkeeping and accounting, calculating machines and office practice. The differences in opinion regarding mathematics was not quite so great between teachers with and without work experience than it was for high school and post high school teachers. However, the differences were not as great generally between the "with and

Table 14-10. Background Courses Helpful for Teaching and for Understanding Data Processing Courses

Courses	For Teaching								For Understanding							
	High School N=196		Post High School N=279		No Work Experience N=149		Work Experience N=326		High School N=196		Post High School N=279		No Work Experience N=149		Work Experience N=326	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Bookkeeping and accounting	122	62.2	166	78.7	97	65.1	191	55.6	126	64.3	167	79.1	101	67.8	192	58.9
Management	47	24.0	87	41.2	29	19.5	105	32.2	45	23.0	84	39.8	31	20.8	98	65.8
Office management	26	13.3	42	19.9	21	14.1	47	14.4	19	9.7	46	21.8	17	11.4	48	14.7
Calculating machine	41	20.9	29	13.7	35	23.5	35	10.7	42	21.4	37	17.5	35	23.5	44	13.5
English	19	9.7	47	22.3	12	8.1	54	16.6	21	10.7	32	15.2	15	10.1	38	11.7
Mathematics	69	35.2	129	61.1	47	31.5	151	46.3	75	38.3	148	70.1	55	36.9	168	51.5
Science	21	10.7	38	18.0	12	8.1	47	14.4	20	10.2	52	24.6	15	10.1	57	17.5
Statistics	33	16.8	71	33.6	20	13.4	84	25.8	45	23.0	81	38.4	29	19.5	97	29.8
Office procedures	62	31.6	76	36.0	47	31.5	91	27.9	61	31.1	75	35.5	50	33.6	86	26.4
Secretarial/ clerical practice	24	12.2	16	7.6	21	14.1	19	5.8	20	10.2	14	7.1	18	12.1	16	4.9
Education	42	21.4	62	29.4	27	18.1	77	23.6	25	12.8	26	12.3	17	11.4	34	10.4

without work experience" teachers as between secondary and post high school teachers, and many were about the same.

However, in the value for providing understanding of data processing, the differences for certain courses were considerably greater among the various groups of teachers. Nearly two-thirds (65.8 per cent) of the teachers with work experience (compared with about 30 and 40 per cent of teachers when classified according to level of teaching) felt that management courses were helpful for understanding data processing; and they felt more strongly that mathematics was a helpful course than when they were classified according to the level at which they taught. Over half (51.5 per cent) of the teachers with work experience said that mathematics was a course that helped in understanding data processing.

Updating Themselves in Data Processing

In the fast developing field like data processing the teachers must constantly keep up-to-date. Teachers accomplished updating by several different means: reading periodicals, attending summer sessions and professional meetings, attending manufacturers' schools, and working in data processing departments in business.

Methods of updating. By far the most popular way for teachers to update themselves in the data processing field is to read periodicals, reported by 83.6 per cent of the teachers (Table 14-11). Reading the current literature was reported by a greater proportion of the post high school teachers than by high school teachers. Half the teachers are on the manufacturers' mailing lists to receive releases about equipment developments and other publications available from equipment and software manufacturers. Again this was reported more frequently by the post high school than high school teachers. Also, relatively frequently mentioned as a means of keeping up-to-date was attending manufacturers' schools, attending data processing seminars and going to meetings of data processing organizations, each reported by about 40 per cent of the teachers, although again reported by a considerably greater percentage of the post high school teachers.

High school teachers tended to keep updated mainly by the same means as do the post high teachers, but to a lesser extent over all.

Membership in professional organizations tends to be mainly in the National Business Education Association and in the Data Processing Management Association, with about an equal proportion of teachers belonging to each of these two organizations, 22.3 per cent and 21.3 per cent, respectively (Table 14-12). However, high school teachers belong to a greater extent to the NBEA (30.6 per cent) than do post high school teachers (16.5 per cent); but the reverse is true with respect to DPMA with 15.8 per cent of the high school

Table 14-11. Methods Used by High School and Post High School Data Processing Teachers to Keep Updated

Method	High School N=196		Post High School N=279		Total N=475	
	No.	%	No.	%	No.	%
Read periodicals	156	79.6	241	86.4	397	83.6
Attend professional data processing meetings	66	33.7	124	44.4	190	40.0
On manufacturers' mailing list	91	46.4	150	53.8	241	50.7
Summer work experience	20	10.2	38	13.6	58	12.2
Attend summer school	37	18.9	53	19.0	90	18.9
Attend night classes	37	18.9	35	12.5	72	15.2
Attend manufacturers' schools	65	33.2	148	53.0	213	44.8
Attend data processing seminars	69	35.2	133	47.7	202	42.5
Other	31	15.8	67	24.0	98	20.6

Table 14-12. Professional Organization Memberships Held by Data Processing Teachers

	High School N=169		Post High School N=211		Total N=380	
Organization	No.	%	No.	%	No.	%
Data processing and business organizations						
Data Processing Management Association	31	18.3	70	33.2	101	26.6
Systems and Procedures Association	6	3.5	19	9.0	25	6.6
Association for Computing Machinery	5	3.0	16	7.6	21	5.5
Machine Accounting Association	2	1.2	12	5.7	14	3.7
Association for Educational Data Systems	4	2.4	4	1.9	8	2.1
Other	5	3.0	7	3.3	12	3.1
Business Education Organizations						
United Business Education Association	60	35.5	46	21.8	106	27.9
American Vocational Association	1	0.6	9	4.3	10	2.6
Delta Pi Epsilon	2	1.2	1	0.5	3	0.8
Other	11	6.5	1	0.5	12	3.1
Unspecified	18	10.6	34	16.1	52	13.7

teachers having membership in this organization and 25.1 per cent of the post high school teachers. Other organizations mentioned, but with considerably less frequency are the Systems and Procedures Association, the Machine Accounting Association and the Association for Computing Machinery.

Of the journals read by data processing teachers, the two most frequently mentioned business and data processing periodicals are Datamation and Computer Digest, with the Journal of Data Management as the third most frequently reported journal read (Table 14-13).

Table 14-13. Periodicals Read by Data Processing Teachers

Periodicals	High School N=196	Post High School N=279	Total N=475
Data processing and business			
Datamation	36	87	123
Business Automation	33	67	100
Journal of Data Management	28	60	88
Data Processing Magazine	12	23	35
Computers & Data Automation	7	24	31
Journal of the Association of Computing Machinery	9	18	27
Data Processor (IBM)	10	16	26
Business education and education			
Balance Sheet	59	25	84
Business Education World	34	20	54
N. E. A. Journal	32	14	46
Business Education Forum	23	12	35
State Education Journal	15	15	30
Business Teacher	20	8	28
Today's Secretary	10	5	15

Other journals read, but to a limited extent, are Data Processing Magazine, Computers and Automation, Journal of the Association of Computing Machinery, Data Processor (IBM), and Data Processing. A total of 66 other periodicals were listed by the teachers to this free response question, but each of these journals was named by only a very small number of teachers. These journals range from Business Week, Fortune, and Nation's Business to Electromechanical Design, CPA Journal, and Computer Design.

Among the most widely read education and business education journals were The Balance Sheet (a publication mailed free of charge to business teachers by a textbook publisher), Business Education World, Business Education Forum and Journal of Business Education. The high school teachers tended to read these periodicals more widely than the post high school teachers did.

Frequency of updating. When asked their opinions about how often data processing teachers as compared with other teachers attended some instructional unit or program such as workshops or summer sessions in order to keep themselves updated, 107 out of 147 department heads felt that data processing teachers attended such classes and programs more often than do other teachers. Only five said they attended less often than other teachers (Table 14-14).

Table 14-14. Frequency With Which High School and Post High School Data Processing Teachers Attend Classes to Keep Updated Compared With Other Teachers

Frequency	High School	Voc-Tech	Junior College	Total
About the same	13	9	13	35
More often	39	20	48	107
Less often	2	1	2	5
No opinion	18	1	9	28
Totals	72	31	72	175

Kinds of programs preferred for updating. Courses in manufacturers' schools were considered by a little over 40 per cent of the data processing department heads to be the most helpful kind of program for updating data processing teachers (Table 14-15). The next most frequently mentioned source of updating programs were the special summer workshops in data processing offered on college campuses, along with institutes and seminars in data processing. The number of department heads expressing these opinions agrees with the number of teachers (40 per cent) who have attended such sessions to update themselves.

Summer work experience. Heads of data processing instructional departments tend not to require their data processing teachers to work in business data processing departments in the summer, with 98 out of 152 saying that getting work experience is not required of the teachers in their schools (Table 14-16). Only two responses indicated that summer work experience was required of the teachers in their schools. However, in the junior colleges over one-fourth of the respondents recommended that teachers work in the summer, although getting such experience was not required. More teachers in high schools than in post high school institutions were reported to be voluntarily getting business experience in the summer even though this was not a requirement in their schools.

Table 14-15. Preferences for Kinds of Programs for Updating High School and Post High School Data Processing Teachers

Preference	High School	Voc-Tech	Junior College	Total
Manufacturers' schools	22	11	29	62
Special summer workshops	17	4	10	31
Institute seminars	4	2	7	13
Regular summer sessions	3	0	5	8
Combinations of above programs	4	5	10	19
Few or not helpful	0	2	2	4
Miscellaneous	4	2	2	8
Totals	54	26	65	145

Table 14-16. Summer Work Experience Required of High School and Post High School Data Processing Teachers

	High Schools		Voc-Tech Schools		Junior Colleges		Total	
Work Experience Required	No.	%	No.	%	No.	%	No.	%
None	38	65.5	22	73.3	38	59.4	98	64.5
None, but recommended	8	13.8	4	13.3	18	28.1	30	19.7
None, but done voluntarily	9	15.5	2	6.7	8	12.5	19	12.5
None, but visit offices	3	5.2	0	0.0	0	0.0	3	2.0
Yes	0	0.0	2	6.7	0	0.0	2	1.3
Totals	58	100	30	100	64	100	152	100

THE DATA PROCESSING TEACHER AND HIS JOB

As a rule, data processing teachers are rather well satisfied with teaching in this field, in which they started to teach mainly because someone asked them to. They teach a variety of students in many fields, both in and outside of data processing.

Reasons for Entering the Data Processing Teaching Field

In about equal numbers data processing teachers said that they started teaching in this field either because administrators had asked them to or because they had worked in the field and thought they would like to teach it (Table 14-17). However, proportionately more post high school teachers had worked in the field (32.5 per cent) than high school teachers (14.7 per cent), and more high school teachers had been asked to teach in data processing than had teachers in the post secondary schools. About one-fifth of the teachers at both levels were interested in the field and had asked to teach it, and a few had been exposed to it in college classes and thought they would like it as a teaching field.

Job Satisfactions and Dissatisfactions

Basically data processing teachers are satisfied with teaching in this field, although some problems do occur. However, considerably fewer teachers expressed dissatisfaction than satisfaction with the field. They seem to derive their satisfactions from the students and from the content of the field itself, while most of the dissatisfaction stems from inadequacy of supplies and facilities.

Satisfactions with teaching in data processing.

When asked what satisfactions they derived from the teaching of data processing courses, most of the teachers said that working with students in one way or another was the main source of their satisfaction with teaching in this field (Table 14-18). The reasons they liked working with students are different, however, for the teachers at the high school and the post high school levels. Proportionately, only about half as many post high school as secondary teachers liked working with students because the attitudes of the students were good, while not quite half as many high school (7.7 per cent) as junior college-vocational technical school teachers (13.5 per cent) indicated that teaching in this field gave them the opportunity to share their knowledge with the students.

Table 14-17. Reasons for High School and Post High School Data Processing Teachers Entering Data Processing Teaching Field

Reasons	High School	Voc-Tech Junior College	Total
Asked by administration	69	64	133
Was interested and asked to do it	43	50	93
Had worked in it and wanted to teach it	28	90	118
Had had class work and wanted to teach it	12	16	28
Combinations of these reasons	38	57	95
Totals	190	277	467

Table 14-18. Satisfactions of High School and Post High School Data Processing Teachers in Teaching Data Processing

	High School N=195		Post High School N=282	
Satisfactions	No.	%	No.	%
Helping students	137	70.3	184	65.9
Like to encourage students in the field	16	8.2	28	9.9
Students' attitudes are good	40	20.5	28	9.9
Sharing knowledge	15	7.7	38	13.5
Helping students prepare for a job	27	13.8	27	9.6
Like to watch student progress	20	10.2	39	13.8
Like being of service to young people	12	6.2	16	5.7
Other	7	3.6	8	2.8
Like being in data processing	66	33.8	117	41.5
Increases one's own competency	3	1.5	27	9.6
Keeps one up-to-date	5	2.6	16	5.7
Future is promising	23	11.8	16	5.7
Challenging field	22	11.3	24	8.5
New field	25	12.8	24	8.5

A greater proportion (41.5 per cent) of post high school teachers indicated their satisfaction with teaching in data processing came from being in this particular field than did high school teachers (33.8 per cent). Twice as great a proportion of high school teachers (11.8 per cent) as post high school teachers (5.7 per cent) liked the data processing field because they felt the future in it was promising. On the other hand, over six times as many junior college-vocational technical school teachers liked the data processing field because of the opportunity it gave them for improving their own competency.

Dissatisfactions with teaching in data processing. Fewer expressions of dissatisfactions were made than of satisfactions, with 504 expressions of satisfactions and 424 dissatisfactions listed by the teachers (Table 14-19). High school and post high school teachers were to a great extent agreed on their dissatisfactions with teaching in data processing, the greatest dissatisfaction being materials, supplies, and facilities, with 40.5 per cent of the high school teachers and 37.2 per cent of the post high school teachers listing dissatisfactions in this area. Lack of equipment was the greatest source of dissatisfaction in both levels of schools and lack of textbooks was the next most frequently named complaint about teaching in the data processing field.

About one-fifth of the high school teachers and about one-fourth of the post secondary teachers felt that pay and working conditions were inadequate. However, very few of the teachers named any one aspect of working conditions as unsatisfactory, with salaries listed the most frequently, although by only 1.0 per cent of the high school teachers and by 6.7 per cent of the post high school teachers. Junior college-vocational technical school teachers were a little more concerned with lack of time for adequate preparation for teaching than were high school teachers, with 4.2 per cent of the post high school teachers listing this as a source of dissatisfaction as against 2.1 per cent of the high school teachers.

Types of Students Taught by Data Processing Teachers

Data processing teachers are more commonly employed in teaching day students than any other group according to the responses made by the teachers to this question. Of the high school data processing teachers, 133 reported teaching day students (Table 14-20), while a greater proportion of post high school teachers reported teaching adults in evening programs than day time students. A greater proportion of the secondary teachers working with high school day students have had no work experience in data processing. On the other hand, a slightly greater proportion of the post high school teachers teaching at the post high school and adult levels have no degrees, but they have work experience in data processing to a greater extent than do the high school teachers.

Table 14-19. Dissatisfactions of High School and Post High School Data Processing Teachers in Teaching Data Processing

Dissatisfactions	High School N=195 No.	%	Post High School N=282 No.	%
Students and classes	46	23.6	83	29.4
No selection of students	14	7.2	26	9.2
Poor background of students	7	3.6	14	5.0
Lack of student interest	10	5.1	9	3.2
Too many students	6	3.1	11	3.9
Hard field	4	2.1	13	4.6
Too many levels of instruction	4	2.1	2	0.7
Data processing credits not accepted for college entrance	0	0.0	3	1.1
Lack of direction	1	0.5	3	1.1
Other	0	0.0	2	0.7
Materials, supplies and facilities	79	40.5	105	37.2
Lack of textbooks	24	12.3	32	11.3
Lack of equipment	46	23.6	52	18.4
Lack of cooperation	3	1.5	2	0.7
Long hours	1	0.5	9	3.2
Lack of standard teaching methods	3	1.5	6	2.1
Other	2	1.0	4	1.4
Pay and working conditions	39	20.0	72	25.5
Lack of preparation time	4	2.1	12	4.2
Poor pay	2	1.0	19	6.7
Not enough class time	4	2.1	6	2.1
Standards not coordinated	6	3.1	7	2.5
Hard to keep updated	3	1.5	6	2.1
Poor publicity	5	2.6	6	2.1
Lack of teacher background	8	4.1	3	1.1
Dislike the field	2	1.0	4	1.4
Administrative policies	4	2.1	7	2.6
Other	1	0.5	2	0.7

Table 14-20. Types of Students Taught by Data Processing Teachers With and Without Degrees and With and Without Work Experience in Data Processing

Types of Students	Degree		Work Experience	
	With	Without	With	Without
High school teachers				
High school day students	133	6	54	85
Post high school day students	21	2	15	8
Adult evening students	72	19	69	22
Other	6	0	5	1
Totals	232*	27	143	116
Post high school teachers				
High school day students	25	7	20	12
Post high school day students	128	24	118	34
Adult evening students	121	49	151	21
Other	33	12	38	7
Totals	307	92	327	74

*Totals are greater than the number of teachers since teachers may teach both day and evening students or both high school and post high school students.

Instructional Area

Data processing teachers instruct in a variety of courses, some of which are outside the data processing field. Post high school teachers tend to teach a greater variety of data processing courses, while high school teachers are involved in more courses outside the field of data processing. High school teachers taught slightly over three different data processing courses apiece while the post high school instructors taught nearly five courses apiece.

Data processing areas. The teachers were asked to list the courses they taught in data processing, a summary of which appears in Table 14-21, showing the number of teachers who indicated teaching each of the various courses. At both the high school and post high school levels, instruction on the key punch and unit record equipment were the most frequently named areas, with introductory work in programming being the third most frequently named area at both educational levels. Post high school programs included introduction to digital computers and unit record systems in quite substantial numbers also. At the high school level, the number of teachers who list teaching of other than key punch and unit record equipment drops considerably with only about three-eighths of the high school teachers indicating they taught some programming, while nearly five-eighths of the post high school teachers indicated that they taught beginning courses in programming. However, nearly an equal proportion of high school teachers and post high school teachers said they taught introduction to digital computers (about 43 and 44 per cent, respectively).

Areas outside of data processing. Data processing teachers did some teaching outside of the data processing field also, more so at the secondary level than at the post high school level (Table 14-22). Of the 169 high school teachers, 53 (31 per cent) said that they taught bookkeeping, and 60 of the 211 post high school teachers (about 28 per cent) taught bookkeeping or accounting besides the data processing courses. At the high school level, the course next most frequently taught by the data processing teachers was typing, while mathematics was the course outside of data processing taught by data processing instructors in the post high school institutions. However, some teachers do teach only in the data processing field, about 22 per cent of the teachers in the secondary schools and over 35 per cent of the junior college-vocational technical teachers.

TEACHERS' OPINIONS

The teachers were asked to express opinions on some matters pertinent to the data processing instructional area. Because people seem to have differing opinions about when students should first be exposed to the concepts of data processing, the teachers who actually teach young people in this field were asked for their ideas concerning this matter. They were also asked about how they thought business could and should contribute to the education of young people going into occupations in the data processing field.

Table 14-21. Data Processing Areas in Which Teachers Are Now Teaching

Areas	High School			Post High School			Totals
	Degree	No Degree	Total	Degree	No Degree	Total	
Introduction to data processing	104	13	117	131	34	165	282
Unit record equipment	91	17	108	115	42	157	265
Unit record system	47	9	56	54	19	73	129
Introduction to systems analysis	19	0	19	44	12	56	75
Data processing systems	24	4	28	47	14	61	89
Introduction to digital computer	47	3	50	72	20	92	142
Computer theory and logic	28	3	31	38	15	53	84
Introduction to programming	57	6	63	106	24	130	193
Advanced programming	13	1	14	59	16	75	89
Data processing applications	36	4	40	43	19	62	102
Field work in data processing	6	2	8	16	13	29	37
Data processing math	15	2	17	27	7	34	51
Other	14	0	14	9	4	13	27

Table 14-22. Areas Other Than Data Processing in Which Teachers are Now Teaching

Areas	High School			Post High School			Totals
	Degree	No Degree	Total	Degree	No Degree	Total	
None	43	21	64	101	50	151	215
Bookkeeping/ accounting	53	0	53	53	7	60	113
Shorthand	19	0	19	8	0	8	27
Typing	45	1	46	17	1	18	64
Office Procedures/ management	11	1	12	9	6	15	27
Secretarial/ clerical practice	39	0	39	11	2	13	52
Introduction to business	18	1	19	12	4	16	35
Management	8	0	8	8	6	14	22
Math	26	0	26	35	5	40	66
Science	6	0	6	3	0	3	9
Social science	5	0	5	3	2	5	10
English	3	0	3	5	1	6	9
Other	26	0	26	9	2	11	37

Grade Level for Introduction of Data Processing

The teachers were asked to express their opinions, on the basis of their experience in teaching data processing, at what level and how should data processing be introduced to young people in schools. Most teachers (both secondary and post high school) felt that data processing should be introduced at the high school level, preferably at the eleventh and/or twelfth grades (Table 14-23).

Table 14-23. Education Level for Introducing Data Processing as Recommended by High School and Post High School Data Processing Teachers

Level	High School	Post High School	Total
Post high school	7	33	40
Freshman (post high school)	3	16	19
Sophomore (post high school)	0	2	2
High school	57	109	166
9th grade	11	1	12
10th grade	15	12	27
11th grade	27	17	44
12th grade	27	23	50
9th and 10th grade	5	1	6
11th and 12th grade	18	16	34
Junior high school	2	9	11
Elementary school	2	4	6
Miscellaneous	1	4	5

The teachers were in definite agreement that data processing should be introduced in a general introductory course, or at least in a formal course situation (Table 14-24). About half of the teachers who suggested an introductory course seemed to think that data processing should be presented as a unit in another course first. Although one of the common courses in high schools is in operation of the key punch machine, only nine teachers felt that data processing should be introduced through such a course and only a few more indicated that it should be introduced through unit record courses.

Table 14-24. Methods for Introducing Business Data Processing as Recommended by High School and Post High School Data Processing Teachers According to Their Degrees and Work Experience

Method	High School	Post High School	Total
Introductory course (general)	36	89	125
Practical courses	14	19	33
Introduction to equipment	2	1	3
Key punch	6	3	9
Key punch and other unit record equipment	8	6	14
Programming	0	6	6
Unit in other courses	40	25	65
Formal classes (general)	11	14	25
Introduction and practical or hands on	6	5	11
Students work at companies (on-the-job training)	3	5	8
Introduction and unit record equipment	0	1	1
Integrated into other courses	0	2	2
Unit record and computer	3	3	6
Complete curriculum	10	24	34
Introduction to unit record and programming	2	3	5
Miscellaneous	2	1	3

The Business Community's Contribution in Data Processing Instruction

Data processing teachers felt that the business community could contribute to the preparation of students in several different ways, especially in providing actual experience either through participation or observation (Table 14-25). Among the most frequently mentioned ways in which business could contribute were these (in order of frequency of mention):

1. To provide opportunities for field trips, to give explanations, and to demonstrate operation of data processing equipment, etc.
2. To provide on-the-job training.
3. To give advice to the schools about curriculum and equipment.
4. To train for the company's specific needs.

Two other phases were mentioned quite frequently, although not as widely as the above four items, both dealing with work experience, are (1) to provide work experience for teachers as well as for students, and (2) to participate in a cooperative work experience program. Although slightly different in the ranking of their suggestions to business, teachers at the high school and post high school levels made the same suggestions.

Table 14-25. Phases of Business Data Processing that Businesses Should Be Expected to Provide as Recommended by High School and Post High School Data Processing Teachers

Phases	High School	Post High School	Total
On-the-job training	29	30	59
Training for companies' specific needs	19	28	47
Field trip opportunities, lectures, etc.	27	50	77
Advice to schools	16	32	48
Hiring students with little or no experience	6	13	19
Use of equipment for data processing classes	9	12	21
Provide work experience (for teachers and students)	11	19	30
Participate in cooperative education program	13	18	31
In-service advanced training	9	12	21
Send employee to manufacturer's school	3	8	11
Financial help in setting up program	9	4	13
Orientation	2	6	8
None or very little	4	7	11
Miscellaneous	4	7	11

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APPENDIX A

Table A-1. Monthly Salary, by Sex, of Data Processing Employees

Salary	Key Punch Oper.		Tape Libr.		Unit Rec. Oper.		Comp. Oper.		Progr.		D.P. Super.		Sys. Anal.	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Under $200	0	3	0	0	0	4	2	1	2	0	0	0	0	0
$200-299	0	50	0	7	4	10	5	7	1	1	0	0	0	0
$300-399	0	50	1	2	12	13	34	14	7	2	0	0	0	0
$400-499	3	20	0	12	20	17	75	20	34	15	2	1	1	0
$500-599	0	0	2	1	8	2	74	5	58	20	24	6	9	1
$600-699	0	0	0	1	8	0	28	2	81	15	32	2	8	2
$700-799	0	0	0	0	0	0	6	0	44	1	33	1	39	2
$800-899	0	0	0	0	0	0	0	0	32	4	26	0	39	1
$900-999	0	0	0	0	0	0	0	0	7	0	13	0	10	2
Over $1,000	0	1	0	0	0	1	2	0	7	1	21	1	24	0
Totals	3	124	3	23	52	47	226	49	273	59	151	11	130	8

Table A-2. Evaluation of Education According to Type of School Attended

Position	Evaluation						Total
	Very well		Adequate		Inadequate		
	N	%	N	%	N	%	
Key Punch Operator	125	16.7	441	58.9	183	24.4	749
Less than high school	2	6.4	22	71.0	7	22.6	31
High school	40	9.9	252	62.5	111	27.5	403
Private business school	50	28.1	97	54.5	31	17.4	178
Some college - no degree	29	22.3	68	52.3	33	25.4	130
Degree	4	57.1	2	28.6	1	14.3	7
Tape Librarian	1	4.2	15	62.5	8	33.3	24
Less than high school	0	0.0	1	100.0	0	0.0	1
High school	1	5.3	13	68.4	5	26.3	19
Private business school	0	0.0	0	00.0	2	100.0	2
Some college	0	0.0	1	50.0	1	50.0	2
Degree	0	0.0	0	00.0	0	00.0	0
Unit Record Equipment Operator	34	10.0	189	55.4	118	34.6	341
Less than high school	1	5.6	8	44.4	9	50.0	18
High school	14	82.4	92	54.1	64	37.6	170
Private business school	3	6.1	29	59.2	17	34.7	49
Some college	14	15.0	54	58.1	25	26.9	93
Degree	2	18.2	6	54.5	3	2.7	11
Computer Operator	25	9.9	153	60.5	75	29.6	253
Less than high school	1	25.0	3	75.0	0	0.0	4
High school	9	8.4	58	54.2	40	37.4	107
Private business school	6	16.7	21	58.3	9	25.0	36
Some college	8	8.0	68	68.0	24	24.0	100
Degree	1	16.7	3	50.0	2	33.3	6
Programmer	42	13.2	182	57.0	95	29.8	319
Less than high school	0	0.0	2	40.0	3	60.0	5
High school	1	1.7	29	50.0	28	48.3	58
Private business school	4	13.8	11	37.9	14	48.3	29
Some college	20	15.7	80	63.0	27	21.2	127
Degree	17	17.0	60	60.0	23	23.0	100
Data Processing Manager	14	9.4	83	55.7	52	34.9	149
Less than high school	0	0.0	0	0.0	3	100.0	3
High school	2	3.7	27	50.0	25	46.3	54
Private business school	1	5.0	16	80.0	3	15.0	20
Some college	8	17.4	25	54.3	13	28.3	46
Degree	3	11.5	15	57.7	8	30.8	26
Systems Analyst	22	16.3	74	54.8	39	28.9	135
Less than high school	0	0.0	0	0.0	0	0.0	0
High school	1	5.9	7	41.2	9	59.2	17
Private business school	0	0.0	4	66.7	2	33.3	6
Some college	14	24.1	29	50.0	15	25.9	58
Degree	7	13.0	34	63.0	13	24.1	54

Table A-3. On-The-Job Training Given Data Processing Employees

Job Title	Typing	Key Punch	Calc. Machine	Unit Record Op. Eqpt.	Wiring Boards	Paper Tape	Computer Console Operation	Intro. to D.P. Concepts	Theory/ Logic	Program-ming	Flow Charting	D.P. Appli-cation
Key Punch Operator	44	271	46	99	36	19	21	65	23	11	15	41
Unit Record	10	110	61	195	179	29	64	107	61	47	87	91
Tape Librarian	7	16	6	14	6	3	15	26	12	8	11	13
Computer Console Operator	11	80	45	132	82	47	220	162	135	121	111	118
Supervising Computer Operator	12	75	54	108	80	45	158	145	146	156	152	156
Programmer	6	81	48	111	56	47	175	178	187	232	207	189
(Manager, (Data (Processing (Assistant (Manager, (Data (Processing	3	14	12	18	17	11	33	33	30	41	30	34
Systems Analyst	4	17	19	28	12	15	36	48	44	53	46	47

Table A-4. Leisure Time Activities of Data Processing Employees

Activity	Sex	Key Punch Oper.	Tape Libr.	Unit Rec. Oper.	Comp. Oper.	Progr.	D.P. Super	Sys. Anal.
		1,341 ans.	39 ans.	158 ans.	460 ans.	575 ans.	278 ans.	248 ans.
Arts and crafts	M	2	0	18	25	29	17	17
	W	279	4	45	10	19	3	3
	Total	281	4	63	35	48	20	20
Household	M	1	1	46	54	63	28	22
	W	96	2	20	7	4	1	1
	Total	97	3	66	61	67	29	23
Hunting and fishing	M	4	1	48	49	66	39	23
	W	15	0	2	1	1	0	0
	Total	19	1	50	50	67	39	23
Outdoor	M	1	0	28	31	37	22	25
	W	184	2	22	11	11	1	2
	Total	185	2	50	42	48	23	27
Reading	M	2	1	32	30	53	30	31
	W	212	6	56	20	30	3	3
	Total	214	7	88	50	83	33	34
TV and movies	M	0	0	6	8	6	3	4
	W	45	2	9	2	2	1	0
	Total	45	2	15	10	8	4	4
Dancing and parties	M	1	0	15	8	15	8	8
	W	95	1	16	10	4	1	1
	Total	96	1	31	18	19	9	9
Travel	M	0	0	4	6	5	4	2
	W	14	3	5	2	1	1	1
	Total	14	3	9	8	6	5	3
Music	M	2	0	24	18	21	10	8
	W	62	2	15	5	11	2	2
	Total	64	2	39	23	32	12	10
Sports participation	M	7	2	67	79	103	50	44
	W	232	8	34	15	12	7	0
	Total	239	10	101	94	115	57	44
Sports spectator	M	7	1	39	38	31	30	15
	W	21	0	6	2	1	0	0
	Total	28	1	45	40	32	30	15
Other	M	1	0	16	28	37	16	35
	W	58	3	19	1	13	1	1
	Total	59	3	35	29	50	17	36
Totals	M	28	6	343	374	466	257	234
	W	1,313	33	249	86	109	21	14
	Total	1,341	39	592	460	575	278	248

Table A-5. Data Processing Activities Performed by Teachers in Data Processing Departments

Activity	High School	Post High School
Operated Key Punch	90	178
Operated Verifier	58	123
Operated Collater, Reproducer	81	175
Wired Boards	77	150
Planned Wiring Diagram	69	141
Operated Sorter	83	182
Operated Accounting Machine	78	165
Operated Paper-Tape	27	98
Operated Data-Converting	28	78
Operated Computer Console	60	158
Written Programs	66	172
Make Block Diagrams	63	168
Make Flow Charts	77	181
Performed Systems Analysis	55	152
Prepared Pert Charts	17	51
Determined Critical Path	16	53
Design Forms for Optical Scanner	9	27
Use Random Access Device	32	106
Operate High-Speed Printer	53	140
Debug Programs	57	157
Run Test Programs	58	160
Other	18	41

Table A-6. Data Processing Activities Performed by Data Processing Teachers in Business, Government, Etc., and in Schools

Activity	BUS., GOV'T, ETC.			SCHOOLS		
	High School	Post H.S.	Total	High School	Post H.S.	Total
Operated Key Punch	90	178	268	125	139	264
Operated Verifier	58	123	181	73	93	166
Operated Collator, Rep.	81	175	256	104	129	233
Wired Boards	77	150	227	111	142	253
Planned Wiring Diagrams	69	141	210	104	134	238
Operated Sorter	83	182	265	108	129	237
Operated Tab. Mach.	78	165	243	101	133	234
Oper. Paper Tape Equip.	27	98	125	24	50	74
Oper. Data Converter	28	78	106	9	41	50
Oper. Computer Console	60	158	218	64	128	192
Written Programs	66	172	238	104	184	288
Make Block Diagrams	63	168	231	89	171	260
Make Flow Charts	77	181	258	105	172	277
Performed System Ana.	55	152	207	36	75	111
Prepared PERT Charts	17	51	68	12	35	47
Deter. Critical Path	16	53	69	12	36	48
Design Forms for Op. Scan.	9	27	36	1	8	9
Used Random Access Dev.	32	106	138	28	73	101
Oper. Hi Speed Printer	53	140	193	36	75	111
DeBug Programs	57	157	214	60	134	194
Run Test Programs	58	160	218	63	112	175
Other	18	41	59	13	20	33

Table A-7. Courses Teachers Have Taken That Are Helpful in Their Teaching of Data Processing

	High School	Post High School	Other
UNDERSTANDING			
Bookkeeping/Accounting	120	156	17
Management	36	83	10
Office Management	20	41	4
Calculating Machines	40	35	4
English	17	34	2
Mathematics	61	152	10
Science	15	55	2
Statistics	36	83	7
Office Procedures	59	72	5
Secretarial/Clerical Practice	18	16	0
Education	21	29	1
Other	13	23	1
TEACHING			
Bookkeeping/Accounting	114	155	19
Management	30	94	10
Office Management	22	40	6
Calculating Machines	38	31	1
English	15	49	2
Mathematics	52	137	9
Science	15	43	1
Statistics	24	72	8
Office Procedures	60	72	6
Secretarial/Clerical Practice	22	18	0
Education	38	64	2
Other	10	20	1

APPENDIX B

APPENDIX B - 1

Management Interview Guide

NATIONAL DATA PROCESSING CURRICULUM STUDY

University of Colorado
Boulder, Colorado

MANAGEMENT INTERVIEW SCHEDULE

Company . . . .
SIC . . . .
Total No. Employees . . . .
DP Employees . . . .
Monthly rental DP eqpt . . . . .
Monthly rental computers . . . .

EQUIPMENT	No.
Key punch	
Verifier	
Card sorter	
Reproducer	
Collator	
Acctg machines	
Calculating punch	
Card reader	
Paper-tape machines	
Disc pack (disc storage) . . .	
Card to tape converter	
Mag tape typewriters	
Computer	
Printer	

Interviewee

Position

Interviewer

Key Punch Oper	Unit Rcrd Eqpt Oper	Tape Lbrn	Cmptr Cnsl Oper	AMT OF EDUCATION	Prgmr	Supvr Cmptr Oprns		
				Desired				
				Minimum				
				AMT OF EXPERIENCE				
				Desired				
				Minimum				
				TRAINING IN DATA PROCESSING				
				Typing Sch				
				OJT				
				Key punch				
				Calc. Machines				
				Unit Rcrd Eqpt--Operating concepts				
				Wiring boards				
				Paper tape eqpt				
				Computer Console Oprn				
				Intro. to DP concepts				
				Intro. to computers--theory and logic				
				Programming				
				Flow charting				
				DP applications				

What is the minimum) desirable) level of educ. for these jobs?

1= H.S.
2= J.C.-Tech.
3= Degree
4= Priv.Bus.Sch.
5= Any post h.s.

In hiring a prospective employee from outside your company, how much previous DP experience do you require for these job categories?

What is the minimum amount of previous experience you will accept?

Which data processing areas do you prefer employees to have studied in school? At what level?

1 - Secondary
2 - Post h.s.

In which DP areas do you require (provide) on--the-job training for each of the jobs?

Where are the OJT classes provided--taught by whom?

1 - In house, own company personnel
2 - Mfr rep, in house
3 - Mfr school
4 - OJT, no formal classes
5.- Local school--on their own
6 --Local school--reimbursed

In which of the following educational areas should people in these jobs have had courses?

Key Punch Oper	Unit Rcrd Eqpt Oper	Tape Lbrn	Cmptr Cnsl Oper	OTHER EDUCATION General Background	Prgmr	Supvr Cmptr Oprns		
				Communications--Oral				
				Written				
				Arts				
				Sciences				
				Social Sciences				
				Logic/Philosophy				
				Algebra				
				Anal. Geometry				
				Trigonometry				
				Calculus				
				Languages				
				Psychology				

Management Courses

				Gen. Princ. Mgt.				
				Personnel				
				Office				
				Records				
				Qual. Control				
				Intro. to Systems				

Finance

				Principles				
				Money and Banking				

Accounting

				1 yr. Princ/Theory				
				2 yr. Princ/Theory				
				Cost				
				Tax				

Key Punch Oper	Unit Rcrd Eqpt Oper	Tape Lbrn	Cmptr Cnsl Oper	General Business	Prgmr	Supvr Cmptr Oprns		
				Intro. to Business				
				Statistics				
				Quant. Analysis				
				Business Law				
				Economics				

PERSONAL TRAITS

What personal characteristics and/or traits do you consider most typical of the people in DP jobs in general?

Are any especially typical of any one particular job?

Key Punch Oper	Unit Rcrd Eqpt Oper	Tape Lbrn	Cmptr Cnsl Oper	NUMBER OF EMPLOYEES	Prgmr	Supvr Cmptr Oprns		
				Men				
				Women				
				SOURCES OF EMPLOYEES				
				Schools				
				Ads				
				Mfrs. Recommendations				
				Inquiries				
				Friends of employees				
				Public Empl Agencies				
				Private Emp. Agencies				
				Promotions				

Where do you get most of the personnel for each of these jobs?
Rank the 3 most impt. sources.

				SUPERVISION REQUIRED				

How often is supervision usually necessary on each of these jobs?

1 - None
2 - Several times daily
3 - Once a day
4 - Several times wkly
5 - Weekly
6 - Continuous
7 - As needed

				SHIFTS AND OVERTIME				
				Shifts				
				Amt. of overtime				

Is there more than one shift for each of these jobs?
How much o/t is usual for each job?

1 - None
2 - 1-3 hrs. wkly
3 - 4-7 hrs. wkly
4 - 8-11 hrs wkly
5 - 12 or more

Key Punch Oper	Unit Rcrd Eqpt Oper	Tape Lbrn	Cmptr Cnsl Oper	PROMOTION PATTERNS	Prgmr	Supvr Cmptr Oprns		
				None				
				Key punch operator				
				Data typist				
				Coding clerk				
				Tape librarian				
				Unit recd eqpt oper				
				Computer console oper				
				Supvr. computer oprns				
				Tab operator				
				Programmer				
				Chief programmer				
				Systems analyst				
				Proj.Dir.-Sr.Sys Anal				
				Manager, DP				
				Other supervisory				

To what job may this person be promoted? (Assuming adequate aptitude scores)

PROBABILITY OF PROMOTION

				High				
				Average				
				Low				
				Hardly any or none				

What is the probability of a person's being promoted from this job?

EFFECT OF EDUCATION ON PROMOTABILITY

				None or little				
				Some				
				Quite a bit				
				Definitely				

Other things being equal, would the amt of education affect his chances for promotion?

What tests do you use for selection of employees for any of these jobs?

Some people say programming should be taught in the high schools, but others say that instruction in computer programming should be left until after high school. What has been your experience, if any, with prospective employees who have studied computer programming in high school?

Has installation of computers and other DP equipment changed the nature of the typist's job in your office? How?

What changes in data processing do you see in the next 3 - 5 years?

Do you plan to change your data processing system in the next 3 - 5 years? How?

APPENDIX B - 2

Data Processing Employee Questionnaire

DATA PROCESSING EMPLOYEE QUESTIONNAIRE

This booklet contains some questions about the education, training, and business office experience of people who work in data processing departments throughout the country. What you, as an employee in a data processing department, tell us will help us provide accurate information to schools for developing better training programs for young people entering this rapidly expanding field.

The questions, for the most part, require only a check mark as an answer, and there are only one or two questions on each page. Your answers are confidential and your questionnaire will in no way be identified with you. We have no record of your name.

We sincerely appreciate your help in this important piece of research.

Mildred Hillestad
Research Associate

F. K. Bangs
Principal Investigator

INSTRUCTIONS

This questionnaire consists of two parts. Instructions for Part I are listed below. Instructions for Part II will be found when you reach that point in the survey.

- - - - - -

Part I

For each statement except the first, make a check mark in the appropriate box at the right side of the page. You need nor concern yourself with the numbers appearing next to the boxes--they are for the keypunch operator's use in our office.

University of Colorado
Data Processing Research Project
National Survey

Code

1. My present job title is ____________________________ ☐ 9-1

2. I got my first job with this company through the following source:

School placement service . . . . ☐ 1
Someone I know told me about an opening . . . . ☐ 2
Answered an advertisement . . . . ☐ 3
U.S. or State Employment Service . . . . ☐ 4
Private employment agency . . . . ☐ 5
Came or wrote to the company about possible opening ☐ 6
Referred by the equipment manufacturer . . . . ☐ 7
Cooperative work program in my school . . . . ☐ 8
Other ________________________________ . . . . . ☐ 9
(10-1)

3. I have worked for this company for

Less than 6 months . . . . ☐ 1
Six months but less than 1 year . . . . . ☐ 2
One year but less than 2 years . . . . . . ☐ 3
Two years but less than 3 years . . . . . ☐ 4
Three years but less than 4 years . . . . ☐ 5
Four years but less than 5 years . . . . . ☐ 6
Five years but less than 10 years . . . . ☐ 7
Ten or more years . . . . ☐ 8
(11-1)

4. I earn a monthly salary, before any deductions, of:

Under $200 . . . . ☐ 1
$200 - $299 . . . . . . ☐ 2
$300 - $399 . . . . . . ☐ 3
$400 - $499 . . . . . . ☐ 4
$500 - $599 . . . . . . ☐ 5
$600 - $699 . . . . . . ☐ 6
$700 - $799 . . . . . . ☐ 7
$800 - $899 . . . . . . ☐ 8
$900 - $999 . . . . . . ☐ 9
$1,000 or over . . . . . ☐ 0
(12-1)

4. My sex is

Male . . . . ☐ 1
Female . . . . . . ☐ 2
(13-1)

5. My age is

Less than 21 . . . . . . ☐ 1
21 through 25 . . . . . . ☐ 2
26 " 30 . . . . . . ☐ 3
31 " 35 . . . . . . ☐ 4
36 " 40 . . . . . . ☐ 5
41 " 45 . . . . . . ☐ 6
46 " 50 . . . . . . ☐ 7
51 " 55 . . . . . . ☐ 8
56 " 60 . . . . . . ☐ 9
Over 60 . . . . ☐ 0
(14-1)

6. Concerning "brain twister" or puzzle-type activities:

I enjoy them . . . . ☐ 1
They are O.K. . . . . ☐ 2
I hate them . . . . . ☐ 3
(15-1)

7. Of the following statements, the one which best describes my attitude toward work in data processing is:

I enjoy this work and desire to remain in it . . . . ☐ 1

I enjoy this work but would like a position outside the data processing field . . . . ☐ 2

I do not enjoy this work but plan to remain in the data processing field . . . . ☐ 3

I do not enjoy this work and plan to get a job outside the data processing field . . . . . . ☐ 4
(16-1)

8. The type of business in which my present firm is engaged is:

Financial (banks, savings & loan, real estate, etc.) ☐ 1
Insurance . . . . ☐ 2
Marketing (retail, wholesale, distribution, etc.) . ☐ 3
Service industries (laundry, advertising, etc.) . . ☐ 4
Transportation (trucking, railroads, etc.) . . . . . ☐ 5
Utilities (electric, gas, telephone, etc.) . . . . . ☐ 6
Agriculture (farming, ranching, feed & grain products) ☐ 7
Mining (minerals, petroleum, etc.) . . . . ☐ 8
Construction, engineering . . . . ☐ 9
Other . . . . ☐ 0
(17-1)

9. Considering both present and past jobs, my total work experience in data processing is:

Less than 6 months . . . . ☐ 1
6 - 12 months . . . . ☐ 2
13 - 24 months . . . . ☐ 3
2 years but less than 3 years . . . . ☐ 4
3 years but less than 4 years . . . . ☐ 5
4 years but less than 5 years . . . . ☐ 6
5 years but less than 7 years . . . . ☐ 7
7 years but less than 10 years . . . . ☐ 8
10 years but less than 15 years . . . ☐ 9
15 years or more . . . . ☐ 0
(18-1)

10. My present job

does not require me to do programming . . . . ☐ 19-1

requires me to do programming in one or more of the following computer languages: ☐

ALGOL . . . . ☐ 20
COBOL . . . . ☐ 21
SPA . . . . ☐ 22
PL-1 . . . . ☐ 23
SPS . . . . ☐ 24
Autocoder . . . . . . ☐ 25
Fortran . . . . ☐ 26
SOAP . . . . ☐ 27
Machine language . . . ☐ 28
Other . . . . ☐ 29

11. My highest level of education is:

- 8th grade or less . . . . ☐ 1
- Less than 4 years of high school . . . . ☐ 2
- Completed high school . . . . ☐ 3
- Private business school . . . . ☐ 4
- Public vocational-technical school . . . . ☐ 5
- One year of college . . . . ☐ 6
- Completed junior college . . . . ☐ 7
- Two years of college . . . . ☐ 8
- More than two years of college but no degree . ☐ 9
- Hold at least one college degree . . . . ☐ 0

(30-1)

12. I attained the above educational level in the year ☐
31,32-1

NOTE: If you have a college degree, please answer the following question; otherwise go directly to question 14 on the next page.

13. My highest college degree or postgraduate level is:

- Bachelor's degree . . . . ☐ 1
- Graduate work but no advanced degree . . . . ☐ 2
- Master's degree . . . . ☐ 3
- Work beyond master's but no doctorate . . . . . . ☐ 4
- Doctorate . . . . ☐ 5
- Post doctoral work . . . . ☐ 6

(33-1)

14. Concerning my high school education,

I did not attend high school (Go directly to item 21, p. 10) ☐ 01

41	☐	Alabama	42	☐	Kentucky	66	☐	N. Dakota
91	☐	Alaska	52	☐	Louisiana	74	☐	Ohio
81	☐	Arizona	12	☐	Maine	53	☐	Oklahoma
51	☐	Arkansas	34	☐	Maryland	94	☐	Oregon
92	☐	California	13	☐	Massachusetts	23	☐	Pennsylvania
82	☐	Colorado	73	☐	Michigan	15	☐	Rhode Island
11	☐	Connecticut	63	☐	Minnesota	36	☐	S. Carolina
31	☐	Delaware	43	☐	Mississippi	67	☐	S. Dakota
39	☐	Dist. C.	64	☐	Missouri	44	☐	Tennessee
32	☐	Florida	84	☐	Montana	73	☐	Texas
33	☐	Georgia	65	☐	Nebraska	87	☐	Utah
93	☐	Hawaii	85	☐	Nevada	16	☐	Vermont
83	☐	Idaho	14	☐	New Hampshire	37	☐	Virginia
71	☐	Illinois	21	☐	New Jersey	95	☐	Washington
72	☐	Indiana	86	☐	New Mexico	38	☐	W. Virginia
61	☐	Iowa	22	☐	New York	75	☐	Wisconsin
62	☐	Kansas	35	☐	N. Carolina	88	☐	Wyoming
						02	☐	Other than one of the states

(Cols. 34-35)

15. This item concerns business courses that you may have studied in high school. Please read the list of 8 courses shown below and complete the following statements about them:

I studied no business courses in high school . . . ☐ 1

The one course that has been most helpful in my present job is

Introduction to business (basic business) . ☐ 2
Typing . . . . ☐ 3
Shorthand . . . . ☐ 4
Calculating machines . . . . ☐ 5
Business math . . . . ☐ 6
Office or secretarial practice . . . . . . ☐ 7
Data processing . . . . ☐ 8
Bookkeeping . . . . ☐ 9
(36-1)

The one course that has been least helpful in my present job is

Introduction to business (basic business) . ☐ 2
Typing . . . . ☐ 3
Shorthand . . . . ☐ 4
Calculating machines . . . . ☐ 5
Business math . . . . ☐ 6
Office or secretarial practice . . . . . . ☐ 7
Data processing . . . . ☐ 8
Bookkeeping . . . . ☐ 9
(37-1)

In addition to the courses shown as most and least helpful, I also studied these courses:

Col.
Introduction to business (basic business) . ☐ 38
Typing . . . . ☐ 39
Shorthand . . . . ☐ 40
Calculating machines . . . . ☐ 41
Business math . . . . ☐ 42
Office or secretarial practice . . . . . . ☐ 43
Data processing . . . . ☐ 44
Bookkeeping . . . . ☐ 45

16. This item concerns other general courses that you may have studied in high school. Check in the appropriate column the extent to which the course has helped you on your present job.

	The most helpful course	The second most helpful course	I wish I could have had more work in these	
General math	☐	☐	☐	1
Elementary algebra	☐	☐	☐	2
Advanced algebra	☐	☐	☐	3
Geometry	☐	☐	☐	4
Trigonometry	☐	☐	☐	5
Analytic geometry	☐	☐	☐	6
Calculus	☐	☐	☐	7
English--Writing and/or speech . . .	☐	☐	☐	8
English--Reading, literature	☐	☐	☐	9
Economics	☐	☐	☐	10
Social studies, history, govt. . . .	☐	☐	☐	11
Science	☐	☐	☐	12
Industrial arts	☐	☐	☐	13
Other vocational classes (ag., home ec.)	☐	☐	☐	14
	(46-47)	(48-49)	(50-59)	

17. While in high school

I participated in a cooperative part-time program (attended class for a half-day and worked under supervision a half-day) . . . . . ☐ 1

I did not participate in a cooperative part-time program . . . . ☐ 2

(60-1)

EDUCATION BEYOND HIGH SCHOOL

18. Concerning education beyond high school,

I did not attend school beyond high school . . . . . ☐ 1
(Go directly to item 21)

I attended school byond high school and my MAJOR area of study was

Social Science (Anthro., Soc., Hist., etc.). . ☐ 2
Math . . . . ☐ 3
Science (Biol., Physics, Chem., etc.) . . . . ☐ 4
Economics . . . . ☐ 5
Business . . . . ☐ 6
English . . . . ☐ 7
Education . . . . ☐ 8
Engineering . . . . ☐ 9
Psychology . . . . ☐ 0
Other . . . . ☐ X

(9-2)

19. This item concerns general courses that you may have studied in school after graduating from high school. Check in the appropriate column the extent to which any course has helped you on your present job.

	The most helpful course	The second most helpful course	I wish I could have had more work in these	
General math				01
Algebra				02
Trigonometry				03
Analytic geometry				04
Calculus				05
English--Writing and/or speech . .				06
English--Reading, literature . . .				07
Economics				08
Social studies, history, govt. . .				09
Science				10
Education				11
Psychology				12
Philosophy, logic				13
Foreign languages				14
Art, music				15
	(10-2)	(11-2)	(12-2)	

20. This item concerns business courses studied in schools after high school graduation before you started working. Check in the appropriate column the courses you have had, the TWO most helpful courses on your present job, and the TWO least helpful.

	The courses I took	Col	TWO most helpful courses		TWO least helpful courses
BUSINESS SKILLS					
Data processing equipment operation . .		22		01	
Calculating machines		23		02	
Typing		24		03	
Shorthand		25		04	
Office or secretarial procedures . . .		26		05	
Business English - letter writing . . .		27		06	
Business report writing		28		07	
Other		29		08	
ACCOUNTING					
Principles (up to one year)		30		09	
Intermediate (second year, general) .		31		10	
Cost		32		11	
Income Tax		33		12	
Advanced		34		13	
Other		35		14	
MANAGEMENT					
Principles of Management . . .		36		15	
Office Management		37		16	
Personnel Management		38		17	
Decision Theory		39		18	
Operations Research		40		19	
Data Processing Applications .		41		20	
Other		42		21	
GENERAL BUSINESS COURSES					
Introduction to Business . .		43		22	
Business Math		44		23	
Statistics		45		24	
Marketing		46		25	
Finance		47		26	
Other		48		27	
			(49-52)		(53-56)

YOUR JOB

21. This item concerns duties you may perform on your job. As you read the list of 47 duties, check off all those that you do. However, for the three duties that take up most of your time, put a 1 in the box for the one you spend most of your time on, 2 for the next most time-consuming, and 3 for the next.

UNIT RECORDS

		Col.
Punch cards	☐	9-3
Verify punched cards	☐	10
Operate collator	☐	11
Wire collator board	☐	12
Operate interpreter	☐	13
Wire interpreter board	☐	14
Operate reproducer	☐	15
Wire reproducer board	☐	16
Operate accounting machines	☐	17
Wire accounting machine boards	☐	18
Sort cards on sorter	☐	19
Code data for unit records system . .	☐	20

SYSTEMS AND PROGRAMMING

Program preparation	☐	21
Make block diagrams	☐	22
Analyze flow of data	☐	23
Make flow charts	☐	24
Analyze systems	☐	25
File and register tapes for future use .	☐	26
Prepare PERT charts	☐	27
Determine critical path scheduling . . .	☐	28
Prepare forms for optical scanning . . .	☐	29
Prepare marked sense cards	☐	30
Prepare wiring diagrams	☐	31

PERIPHERAL EQUIPMENT

Operate paper-tape equipment	☐	32
Operate data-converting equipment (card-to-tape)	☐	33
Operate teletype	☐	34
Operate typewriter	☐	35
Use dataphone	☐	36
Operate computer	☐	37

COMPUTER WORK

Operate a computer console	☐	38-3
Use random access devices	☐	39
Operate high speed printer	☐	40
Wire high speed printer	☐	41
Test sample routines on the computer . . .	☐	42
Debug computer programs	☐	43
Monitor computer console	☐	44
Coding for programming	☐	45
Operate optical scanner	☐	46

SUPERVISORY AND MANAGEMENT

Schedule computer time	☐	47
Confer with other personnel about problem to run on computer	☐	48
Confer with other personnel about forms design for key-punch recording	☐	49
Supervise key-punch operators	☐	50
Supervise auxiliary equipment operators	☐	51
Supervise computer personnel	☐	52
Schedule work for key-punch unit	☐	53
Schedule work for tab unit	☐	54
Revise and update data on basic punch card file . . .	☐	55

OTHER DUTIES NOT LISTED (Please specify)

____________________________________ ____ 56

____________________________________ ____ 57

____

____

NOTE: The next and final section of Part I concerns specific training you may have had in data processing both before and after starting to work in the data processing field.

TRAINING IN DATA PROCESSING

22. BEFORE starting work in data processing, I

did not have training of any kind in that field . . (Go directly to item 23)	☐	1
did have training in some phase(s) of data processing	☐	2
	(9 - 4)	

Following is a list of places where training in several areas of data processing may be obtained. On the opposite page is a list of data processing areas in which you may have had training. This time instead of putting a check in the box, please write in the number of the place where you obtained MOST of your training in that particular area. Leave blank any area in which you have not had any training.

1 - High school

2 - High school cooperative -- part-time work

3 - College or other public school following high school

4 - Special data processing school

5 - Private business school

6 - Classes run by equipment manufacturer (IBM, Univac, CD)

7 - Military

These are the areas of data processing in which you may have received training before working in the field. Please refer to the list of training institutions on the opposite page to find the number to insert in the boxes.

Key punch simulator	☐	10-4
Key punch machine	☐	11
Card sorter	☐	12
Accounting machines (tabulator)	☐	13
Collator	☐	14
Reproducer	☐	15
Interpreter	☐	16
Wiring boards	☐	17
Computer console operation	☐	18
Random access devices	☐	19
Data converting equipment	☐	20
Paper-tape equipment	☐	21
Introduction to data processing	☐	22
Computer logic/theory	☐	23
Introduction to systems	☐	24
Operations research	☐	25
Math for data processing	☐	26
Number systems (binary, octal, etc.) . .	☐	27
Programming	☐	28
Other tab equipment operation	☐	29
Other	☐	30

23. AFTER starting work in data processing,

I have not received on-the-job training of any kind (Go directly to Part II of the questionnaire)	☐	1
I have received on-the-job training	☐	2

Following is a list of ways in which in-service training may have been provided by the companies for which you have worked. On the opposite page is a list of areas in which you studied after starting work. For each of the areas listed on the opposite page in which you have received in-service training, write in the number of the way the company provided this training.

1 - Company provided classes taught by someone in the company

2 - Company sent me to the equipment manufacturer's school

3 - Company provided classes on-the-job taught by a representative from the equipment manufacturer

4 - I took classes on my own at a nearby school outside of working hours

5 - Learned it on-the-job by doing it under supervision

6 - Company sent me to a local school (paid my tuition)

7 - Company gave me time off from work to attend classes at a local school in the city (at my own expense)

8 - Other

These are areas of data processing in which you may have received training AFTER you started working in the data processing field. Please refer to the list of ways the company may have provided the training on the opposite page to find the number to insert in the appropriate boxes.

Key punch simulator	☐	30-4
Key punch machine	☐	31
Card sorter	☐	32
Accounting machine (tabulator)	☐	33
Collator	☐	34
Reproducer	☐	35
Interpreter	☐	36
Wiring boards	☐	37
Summary punch	☐	38
Other tab equipment operation	☐	39
Computer console operation	☐	40
Random access devices	☐	41
Data converting equipment	☐	42
Introduction of data processing (a course)	☐	43
Paper-tape equipment	☐	44
Computer logic/theory	☐	45
Introduction to systems	☐	46
Operations research	☐	47
Math for data processing	☐	48
Number systems (binary, octal, etc.)	☐	49
Programming (specify)	☐	50
Data processing applications	☐	51
Accounting	☐	52
Management	☐	53
Office management	☐	54
Financial analysis	☐	55
Statistics	☐	56
Economics	☐	57
Production courses	☐	58
Marketing	☐	59

DATA PROCESSING EMPLOYEE QUESTIONNAIRE

PART II

The remainder of the questionnaire is to be completed by filling in the appropriate blanks or checking the blocks to complete the statements. Please write your answers in the space provided for each item.

---

31. My present job is

The first and only position I have held in this company ☐ 1

Not the only position I have held in this company. The other job titles, in order from my first job up to the current one, were: ☐ 2

(10-5)

☐ 11
☐ 12
☐ 13

32. That which I like BEST about my present job is:

☐ 14
☐ 15
☐ 16

33. That which I like LEAST about my present job is:

☐ 17
☐ 18
☐ 19

4. Before coming to this company,

I had not held other data processing jobs . . . . . . ☐ 1

I held the data processing jobs identified below . . ☐ 2

(20)

Job Title		Location (State)		Type of Industry (See code below)	
☐	21	☐	24	☐	27
☐	22	☐	25	☐	28
☐	23	☐	26	☐	29

Industry Code

1 - Agriculture, forestry, and fisheries
2 - Mining
3 - Contract construction
4 - Manufacturing
5 - Transportation, communication
6 - Electric, gas, and sanitary services
7 - Wholesale and retail trade
8 - Finance
9 - Insurance, real estate
0 - Services
X - Government
XY - Nonclassifiable establishments

5. Before starting work in data processing

I had held no other jobs in any capacity . . . . ☐ 1

I held the jobs listed below, not in data processing . . ☐ 2

(30-1)

Job Title		Location (State)		Type of Industry (Code above)	
☐	31	☐	34	☐	37
☐	32	☐	35	☐	38
☐	33	☐	36	☐	39

6. My two major hobbies, leisure, or pasttime interests are:

☐ 40

☐ 41

7. I feel that the education I received before starting work in the field of data processing:

Prepared me extremely well for this type of work . . . ☐ 1

Gave me adequate preparation for this type of work . . ☐ 2

Failed to prepare me adequately for this type of work ☐ 3

(42-1)

8. What recommendations would you make for schools in preparing young people for doing a job like yours?

☐ 43

☐ 44

☐ 45

APPENDIX B - 3

Data Processing Teacher Questionnaire

G. TEACHERS

1. In what DP areas are you teaching now?

Intro. to DP	☐	10-1
Unit record eqpt.	☐	11-1
Unit record systems	☐	12
Intro. to systems analysis	☐	13
DP systems	☐	14
Intro. to digital computers	☐	15
Computer theory/logic	☐	16
Intro. programming	☐	17
Advanced programming	☐	18
DP applications	☐	19
Field work in DP	☐	20
Data processing math	☐	21
Other	☐	22

2. In what areas do you teach other than in DP?

None	☐	23-1
Bookkeeping/ Accounting	☐	24
Shorthand	☐	25
Typing	☐	26
Office procedures/management	☐	27
Secretarial/Clerical practice	☐	28
Intro. to Business	☐	29
Management	☐	30
Math (Alg., Geom., etc.)	☐	31
Science	☐	32
Social Science	☐	33
Engineering	☐	34
Other	☐	35

3. What group(s) of students do you teach?

High school day students	☐	36
Post high school day students	☐	37
Adult evening students	☐	38
Other	☐	39

4. Please indicate the highest level of education you have completed by writing the year you completed school in the appropriate blank.

Less than four years of high school	☐	1
Completed high school	☐	2
Private business school	☐	3
Public vocational-technical school	☐	4
One year of college	☐	5
Two years of college	☐	6
More than two years of college, but no degree	☐	7
Hold at least one college degree	☐	8
Other ____________	☐	
	(40-1)	

IF YOU HAVE A DEGREE, please check the highest degree you hold:

Bachelor's	☐	1
Graduate work, but no advanced degree	☐	2
Master's	☐	3
Work beyond master's, but not a doctorate	☐	4
Doctorate	☐	5
	(41-1)	

5. IF YOU HAVE A DEGREE, what was your college major? your minor?

	Major: Under grad.	Major: Grad.		Minor: Under grad.	Minor: Grad.	
1	☐	☐	Business	☐	☐	1
2	☐	☐	Business education	☐	☐	2
3	☐	☐	Math	☐	☐	3
4	☐	☐	Science	☐	☐	4
5	☐	☐	Social sciences	☐	☐	5
6	☐	☐	Psychology	☐	☐	6
7	☐	☐	Engineering	☐	☐	7
8	☐	☐	English	☐	☐	8
9	☐	☐	Ind. Arts; Agr., etc.	☐	☐	9
0	☐	☐	Education	☐	☐	0
X	☐	☐	Other	☐	☐	X
	(42)	(43)		(44)	(45)	

5. How did you get started teaching in DP field?

Was asked to by administration	☐	1
Interested in it and asked to do it	☐	2
Thought someone had to do it	☐	3
Had worked in the field and thought I'd like to teach it	☐	4
Had some class work in it and thought I'd like to teach it	☐	5
Other	☐	6
	(46)	

6. How did you get the DP background to prepare for teaching in this field? Indicate each of the ways in which you received preparation in DP by writing in the year you did this.

Attended manufacturers schools	☐	47
College classes	☐	48
Attended DP workshops during summer	☐	49
Had work experience in DP department	☐	50
Attended night classes in a school	☐	51
Used programmed textbooks on my own	☐	52
On-the-job training	☐	53
Military	☐	54
Other	☐	55

7. How many months of data processing work experience have you had?

☐
(56-57)

8. If you have worked in DP, in what two types of business firms have you had most of your DP work experience?

Accounting	1	☐	Insurance	7	☐
Consulting	2	☐	Manufacturing	8	☐
Education	3	☐	Public Utility	9	☐
Mining-Petroleum	4	☐	Financial	10	☐
Government	5	☐	Military	11	☐
Distributive	6	☐	Other	12	☐

9. Which of the following list of DP activities have you performed in the courses you have had in schools (include mfrs. schools) or in getting actual experience in a business, govt., or military DP installation?

		DP Dpt.	School	
Operated key punch	10	☐	☐	32
Operated verifier	11	☐	☐	33
Operated collator, reproducer, or interpreter	12	☐	☐	34
Wired boards	13	☐	☐	35
Planned wiring diagrams	14	☐	☐	36
Operated sorter	15	☐	☐	37
Operated acctg. (tab) machines	16	☐	☐	38
Operated paper-tape equipment	17	☐	☐	39
Operated data-converting equipment	18	☐	☐	40
Operated computer console	19	☐	☐	41
Written programs	20	☐	☐	42
Make block diagrams	21	☐	☐	43
Make flow charts	22	☐	☐	44
Performed systems analysis	23	☐	☐	45
Prepared PERT charts	24	☐	☐	46
Determined critical path schedule	25	☐	☐	47
Designed forms for optical scanning	26	☐	☐	48
Used random access devices	27	☐	☐	49
Operated high-speed printer	28	☐	☐	50
Debug programs	29	☐	☐	51
Run test programs	30	☐	☐	52
Other	31	☐	☐	53

10. What data processing courses have you studied? (Check the course titles closest to ones you may have had.)

Intro. to DP	☐	10-2
Unit record equipment	☐	11
Wiring	☐	12
Keypunch	☐	13
DP applications	☐	14
DP systems	☐	15
Systems analysis	☐	16
Intro. to systems analysis	☐	17
Intro. to digital computers	☐	18
Intro. to computer programming	☐	19
Advanced computer programming	☐	20
Computer applications	☐	21
Operations research	☐	22
Data processing math	☐	23
Computer theory/logic	☐	24
Other	☐	25

11. What three areas other than strictly DP courses have you found particularly helpful in your understanding of DP and for teaching DP courses? (Rank them 1 - 3, 1 most helpful)

	For Tchg.	For Under-standing	
Bookkeeping and accounting	☐	☐	1
Management courses	☐	☐	2
Office management	☐	☐	3
Calculating machines	☐	☐	4
English	☐	☐	5
Math	☐	☐	6
Science	☐	☐	7
Statistics	☐	☐	8
Office procedures	☐	☐	9
Secretarial/Clerical practice	☐	☐	0
Education	☐	☐	X
Other	☐	☐	Y

12. how do you keep updated in data processing?

Read periodicals	☐	1
Attend meetings of DP organization	☐	2
On mailing list of eqpt. and supplies manufacturers	☐	3
Get summer work experience in DP	☐	4
Attend summer school	☐	5
Attend night school (extension, etc.)	☐	6
Attend manufacturers schools	☐	7
Attend seminars, etc., sponsored by DP professional organizations	☐	8
Other	☐	9
	(32-3)	

13. To what DP organizations and/or business education organizations do you belong?

NBEA and allied associations	☐	1
Data Processing Management Assn.	☐	2
Systems and Procedures Assn.	☐	3
Administrative Management Society	☐	4
Cost Accounting Assn.	☐	5
Machine Accountants Assn.	☐	6
Other	☐	7
	☐	8
	(33-3)	

14. What professional journals do you read?

Data Processing	Education and Business Education
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
(34 - 37)	(38 - 41)

15. What satisfactions do you find in teaching in the data processing field?

____ 42
____ 43
____ 44

16. What dissatisfactions do you have with teaching in the data processing field?

____ 45
____ 46
____ 47

17. At what education level do you think business data processing should be introduced?

How?

☐ 48
☐ 49

18. At what level should these phases of DP be taught for vocational competency?

Keypunch . . . . ☐ 50
Other unit record eqpt. . ☐ 51
Computers and other eqpt. ☐ 52

19. What, if any, phases of business data processing should business be expected to provide?

☐ 53
☐ 54
☐ 55

APPENDIX B - 4

School Questionnaire

6

I. ORIGIN AND DEVELOPMENT OF THE PROGRAM

1. When did your school first offer instruction in any phase of data processing for business?

☐ (10-1)

2. What was the primary reason for starting this work in your school?

Industry needed trained personnel . . . . ☐ 1
Could place students with this training . ☐ 2
Needed it to keep curriculum updated . . ☐ 3
Industry wanted to upgrade DP employees . ☐ 4
Ind. wanted to retrain employees for DP . ☐ 5
Teacher(s) interested in DP as a field . ☐ 6
Community survey showed a need for it . . ☐ 7
Students were interested in it . . . . . ☐ 8
Money was available for equipment . . . . ☐ 9
Other reasons . . . . ☐ 0
(11-1)

3. Who more than anyone else provided the impetus to start the program?

Administration . . . . ☐ 1
Community (parents) . . . . ☐ 2
Business and industry . . . . . . ☐ 3
Business education faculty . . . ☐ 4
Math and/or science faculty . . . ☐ 5
Eng. and/or tech. faculty . . . . ☐ 6
Equipment manufacturers . . . . . ☐ 7
Students . . . . ☐ 8
Other . . . . ☐ 9
(12-1)

National Data Processing Curriculum Study
School of Business
University of Colorado
Boulder, Colorado 80302

4. When the decision was made to include data processing in the curriculum, how was it introduced?

Mentioned in other classes--no formal unit ☐ 1
Introduced as a unit in another class . . ☐ 2
Used a practice set in another class . . . ☐ 3
Organized a series of courses . . . . . . ☐ 4
Organized an introductory class . . . . . ☐ 5
Other . . . . ☐ 6
(13-1)

5. What three administrative problems have you found to be most serious in establishing your program? In operating it? (Rank, with 1 the most serious)

		Est.	Oper.	
Financing the program	14	☐	☐	23-1
Selection of equipment	15	☐	☐	24
Selling the program to the public.	16	☐	☐	25
Selling program to the admin. . .	17	☐	☐	26
Fixing resp. of mntng. eqpt. . . .	18	☐	☐	27
Getting service on equipment . . .	19	☐	☐	28
Getting teachers	20	☐	☐	29
Schedg. adm., instr. time on eqpt.	21	☐	☐	30
Other	22	☐	☐	31

6. What three instructional problems have you found most serious? (Rank, with 1 most serious)

Curriculum development . . . . ☐ 32-1
Phil. difference among depts. involved . . ☐ 33
Placement of students on jobs . . . . . . ☐ 34
Scheduling students on the eqpt. . . . . . ☐ 35
Selecting the students for the program . . ☐ 36
Eval. student work in class, setting standards, est. grades, etc. . . . . . . ☐ 37
Getting DP grades accepted by colleges . . ☐ 38
Arranging for field experience . . . . . . ☐ 39
Keeping updated . . . . ☐ 40
Asked to do too many outside jobs on eqpt. ☐ 41
Other . . . . ☐ 42

INTERVIEW GUIDE FOR SCHOOL INTERVIEWS

7. What is the primary objective of your dept in offering DP instruction?

Vocational preparation of students ☐ 1
Provide general knowledge about DP ☐ 2
Provide acquaintanceship skill in equipment operation and allied procedures ☐ 3
Provide knowledge of business applications of DP ☐ 4
Provide retraining of employees not now in DP ☐ 5
Upgrade present DP employees ☐ 6
Other ☐
(43-1)

8. How has your DP program changed since you started it?

Added courses ☐ 44-1
Combined courses (detail below) ☐ 45
Added eqpt (more on next sheet) ☐ 46
Standards have changed ☐ 47
Students selected more carefully ☐ 48
Other ☐ 49

9. How do you determine necessary changes?

Follow-up studies of students ☐ 50
Talk with businessmen ☐ 51
Read research ☐ 52
Read journals ☐ 53
Talk with other DP teachers ☐ 54
Eqpt. manufacturers suggestions ☐ 55
Administrative directives ☐ 56
Other ☐ 57

10. What, if any, differences are there in the program offered to adult evening school students and the regular students?

More advanced work offered to adults ☐ 58-1
Work presented at a more rapid pace ☐ 59
Work presented at a slower pace ☐ 60
More courses are available to adults ☐ 61
Fewer courses available to adults ☐ 62
More hands-on training for adults ☐ 63
Work presented in larger blocks of time, less often, for adults ☐ 64
Different approach and emphasis ☐ 65
Same program ☐ 66
Other ☐ 67

11. If you have adult evening students, what reasons do they have for taking the programs you offer?

Retraining--moving from present job into a DP job ☐ 68-1
Upgrading--moving from one DP job to another ☐ 69
Pre-employment training ☐ 70
Updating for mgrs. and accountants ☐ 71
Other ☐ 72

12. Are your adult programs designed for these specific needs?

Yes ☐ 1
No ☐ 2
(73-1)

II. STUDENTS

1. Students in which grades are enrolled in your DP courses?

Secondary:
10, 11, 12 ☐ 1
11, 12 . ☐ 2
12 . . . ☐ 3
11 . . . ☐ 4
10 . . . ☐ 5
Other . . ☐
(10-1)

Post High School:
Pre-employment day classes . . ☐ 11-1
Pre-employment night classes . ☐ 12
Adult evening program . . . . . ☐ 13
MDTA . . . . ☐ 14

2. How do you select students for the DP courses?

		Sec.	PHS	
Test scores	15	☐	☐	21
GPA - general	16	☐	☐	22
GPA - specific courses.	17	☐	☐	23
Certain characteristics	18	☐	☐	24
No selection is done .	19	☐	☐	25
Other	20	☐	☐	26

3. If tests are used, which ones?

Math Apt ________ ☐ 27-1
Math Achv ________ ☐ 28
Logic ________ ☐ 29
Schol.Apt ________ ☐ 30
Quant ________ ☐ 31
Ling ________ ☐ 32
Reading ________ ☐ 33
Programmers________ ☐ 34
Other ________ ☐ 35

4. How are the tests used?

Established cut-off scores . . . . ☐ 36-1
Over-all pattern of test scores . ☐ 37
Establishing norms . . . . ☐ 38
Other . . . . ☐ 39

5. Courses in what areas are prerequisites for the DP program? Do you require certain grades in them?

		Crs.	Gr.	
Math ________	39	☐	☐	47-1
Science ________	40	☐	☐	48
Typing ________	41	☐	☐	49
Bkpg./Acctg. ________	42	☐	☐	50
Office Prcdrs ________	43	☐	☐	51
Intro. Bus ________	44	☐	☐	52
English ________	45	☐	☐	53
Other ________	46	☐	☐	54

6. Have you noticed any particular personal characteristics in the successful DP students?

Persistence in problem solving . . . ☐ 55-1
Liking for puzzle-type activities . ☐ 56
Creativeness, novel approaches to problem solving . . . . ☐ 57
Systematic work habits . . . . ☐ 58
Attention to details . . . . ☐ 59
"Machine happy" . . . . ☐ 60
Other . . . . ☐ 61

III. STAFFING

1. How many teachers do you have instructing in your DP program?

Full-time ☐ 10,11
Part-time ☐ 12,13

Full-time Teachers

2. Compared with other teachers, how often do DP teachers attend summer sessions, workshops, institutes or special classes to keep updated?

About the same . . ☐ 1
More often . . . . ☐ 2
Not as often . . . ☐ 3
(14-1)

3. What kinds of schools are most effective for updating DP teachers?

Special summer DP workshops . . . . ☐ 1
Regular summer session classes . . ☐ 2
Manufacturers schools . . . . ☐ 3
Other . . . . ☐ 4
(15-1)

4. Are your full-time teachers expected to work in DP departments in business during the summer to get actual work experience on the equipment?

Yes . . . . ☐ 1
No . . . . ☐ 2
No, but recommended . . . . . . ☐ 3
No, but they do voluntarily . . ☐ 4
No, but they visit offices . . ☐ 5

Part-time Teachers

5. Do you use DP personnel from business offices to teach some courses?

Day classes: Yes ☐ 1
No ☐ 2
(17-1)
Night classes: Yes ☐ 1
No ☐ 2
(18-1)

6. What courses do these people teach?

Key punch . . . . ☐ 19-1
Reproducer, collator, interpreter, etc. . ☐ 20
Tab (acctg) machines (wiring) . . . . . . ☐ 21

Unit record systems . . . . ☐ 22
Computer theory/logic . . . . ☐ 23
Systems analysis . . . . ☐ 24
Programming . . . . ☐ 25
Programming systems . . . . ☐ 26

Computer console operation . . . . ☐ 27
DP applications . . . . ☐ 28
DP math . . . . ☐ 29
DP systems . . . . ☐ 30

Other ☐ 31
☐ 32
☐ 33

3. What qualifications (preparation) do you look for in selection of your part-time instructors?

Experience: Teaching . . . . ☐ 34-1
Business/Govt. DP . . . . ☐ 35

Education: H.S. . . . . ☐ 36
Bus. or trade school . . ☐ 37
J.C. or some college . . ☐ 38
College degree . . . . . ☐ 39
Graduate degree . . . . . ☐ 40

Background Courses: Business courses . . . . ☐ 41
DP courses . . . . ☐ 42
Math . . . . ☐ 43
Science . . . . ☐ 44
Psychology . . . . ☐ 45
Psychology of learning . ☐ 46
Other education courses . ☐ 47

Other . . . . ☐ 48

D. Placement Procedures

1. What placement services does your school offer the DP students?

Department helps place them	☐	10-11 11
School has a placement service	☐	
Work through public employment agencies (USES or State Employment Service) . . .	☐	12
Work through private employment agencies .	☐	13
No placement service provided	☐	14
Other	☐	15

2. Where do most of your students get jobs? (Check only one choice.)

All over the country .	☐	1
Locally	☐	2
Nearby large cities .	☐	3
Other	☐	4
	(16-11)	

3. What problems do you have in placing students? (Rank from 1-3 most impt. probs., 1 most serious)

No particular problems	☐	17-11
Businesses hire students before they complete their DP course work	☐	18
Business reluctant to hire girls	☐	19
Jobs above tab eqpt. operation seem to require more education than we provide .	☐	20
Other	☐	21

E. Financing the Program

1. Where does the money come from to buy, rent, or lease your equipment and supplies? (Indicate the percentage coming from each source. Figures should add to 100% in each column.)

		Eqpt.	Suppl.	
Fed. Govt. NDEA	22,23	☐	☐	36,37
Voc. Ed. Act .	24,25	☐	☐	38,39
MDTA	26,27	☐	☐	40,41
State Funds	28,29	☐	☐	42,43
Local Funds	30,31	☐	☐	44,45
Foundation Grant	32,33	☐	☐	46,47
Other	34,35	☐	☐	48,49

2. If you bouth your computer and other equipment, from whom did you buy it?

		Comp.	Other	
Government surplus	50	☐	☐	55
Used eqpt. from manufacturer .	51	☐	☐	56
New eqpt from manufacturer . .	52	☐	☐	57
Used eqpt from machines dealer.	53	☐	☐	58
Other	54	☐	☐	59

3. Where is your equipment located (other than computer)?

In each school	☐	1
Centralized in one school .	☐	2
Bus./Govt. Office	☐	3
Other	☐	4
	(60-11)	

4. Where is your computer, and how do students get to use it?

Bus./Govt. Office	- Transport students . .	☐	1
	- Transport data	☐	2
	- Dataphone	☐	3
	- Teletype	☐	4
Sch. Adm. Office	- Transport students . .	☐	5
	- Transport data	☐	6
	- Dataphone	☐	7
	- Teletype	☐	8
Our own department		☐	9
		(61-11)	

F. Cooperative Part-time Programs

1. Do you have a cooperative part-time program in office occupations?

Yes ☐ 1
No ☐ 2
(62-11)

2. Is DP one of the areas in which students may work in business for their on-the-job training?

Yes ☐ 1
No ☐ 2
(63-11)

3. Who does the coordinating in the DP area?

Office occupations coordinator . ☐ 1
Special DP coordinator . . . . . ☐ 2
Voc. Ed. coordinator . . . . . . ☐ 3
Div. occupations coordinator . . ☐ 4
Other . . . . ☐ 5
(64-11)

4. On what bases are DP students selected for participation in the coop. program?

No selection process used . . ☐ 65-11
Business course grades . . . . ☐ 66
Over-all course grades . . . . ☐ 67
DP course grades . . . . ☐ 68
Special tests . . . . ☐ 69
Other . . . . ☐ 70

5. Do the cooperative part-time DP students take the same sequence of DP courses that other students take?

Yes ☐ 1
No ☐ 2
(71-11)

If not, how does their program differ? ☐ 72-11

6. Do the coop. students complete all their class work in DP before they are placed in their work stations?

Yes ☐ 1
No ☐ 2
(73-11)

7. What level of skill is required before placement in their work stations?

Acquaintance . . . . ☐ 1
Beginning vocational skill . ☐ 2
Good operational skill . . . ☐ 3
Other . . . . ☐ 4
(74-11)

8. Do the students receive h.s. course credit for their on-the-job work?

Yes ☐ 1
No ☐ 2
(75-11)

9. How many semester do students work on a job in business?

☐ 76-11

10. Compared with general office occupations placements, how difficult is it to find work stations for DP students?

As easy to place as general O.O. students .. ☐ 1
More easily placed . . . . ☐ 2
Not as easily placed . . . . ☐ 3
(77-11)

If NOT AS EASILY PLACED, what are reasons given by businesses for not offering work stations for these people?

☐ 78-11

H. Textbooks and Supplies

Text	Supp.	
		Arnold, Hill, and Nichols, INTRODUCTION TO DATA PROCESSING, John Wiley & Sons
		Awad, BUSINESS DATA PROCESSING, Prentice-Hall, Inc.
		Bell, A MANAGEMENT GUIDE TO ELECTRONIC COMPUTERS, McGraw-Hill Book Co.
		Boulding & Spivey, LINEAR PROGRAMMING AND THE THEORY OF THE FIRM, The Macmillan Co.
		Canning, ELECTRONIC DATA PROCESSING FOR BUSINESS AND INDUSTRY, John Wiley & Sons
		Chapin, AN INTRODUCTION TO AUTOMATIC COMPUTERS, D. Van Nostrand
		Davis, AN INTRODUCTION TO ELECTRONIC COMPUTERS, McGraw Hill Book Co.
		Desmonde, COMPUTERS AND THEIR USES, Prentice-Hall, Inc.
		Elliott & Wasley, BUSINESS INFORMATION PROCESSING SYSTEMS, Richard D. Irwin, Inc.
		Gotlieb & Hume, HIGH SCHOOL DATA PROCESSING, McGraw-Hill Book Co.
		Grabbe, Ramo & Wooldridge, CONTROL FUNDAMENTALS. VOLUME 1 of HANDBOOK OF AUTOMATION, John Wiley & Sons
		Gregory & Van Horn, AUTOMATIC DATA PROCESSING SYSTEMS, 2nd EDITION, Wadsworth Publishing Co.
		Gregory & Van Horn, BUSINESS DATA PROCESSING AND PROGRAMMING, Wadsworth Publishing Co.
		Gregory & Van Horn, PROGRAMMING PACKAGE, Wadsworth Publishing Company
		Haga, UNDERSTANDING AUTOMATION, The Business Press
		Hein, INTRODUCTION TO ELECTRONIC DATA PROCESSING, D. Van Nostrand
		Inman, FUNDAMENTALS OF ELECTRONIC DATA PROCESSING: A PROGRAMMED TEXT, Prentice-Hall, Inc.
		Jeenel, PROGRAMMING FOR DIGITAL COMPUTERS, McGraw-Hill Book Company
		Kahn, BUSINESS DATA PROCESSING: BASIC PRINCIPLES AND APPLICATIONS, McGraw-Hill Book Co. (Gregg)
		Kaufmann, METHODS AND MODELS OF OPERATIONS RESEARCH, Prentice-Hall, Inc.
		Kozmetsky & Kircher, ELECTRONIC COMPUTERS AND MANAGEMENT CONTROL, McGraw-Hill Book Co.
		Laurie, COMPUTERS AND HOW THEY WORK, South-western Publishing Co.
		Lazzaro, SYSTEMS AND PROCEDURES: A HANDBOOK FOR BUSINESS AND INDUSTRY, Prentice-Hall
		Leeds & Weinberg, COMPUTER PROGRAMMING FUNDAMENTALS, McGraw-Hill Book Co.
		Littlefield & Rachel, OFFICE AND ADMINISTRATIVE MANAGEMENT: SYSTEMS ANALYSIS DATA PROCESSING, AND OFFICE SERVICES, 2nd EDITION, Prentice-Hall

Text	Supp.	
____	____	Maley & Skiko, MODERN DIGITAL COMPUTERS, Prentice-Hall, Inc.
____	____	Martin, ELECTRONIC DATA PROCESSING: AN INTRODUCTION, Richard D. Irwin, Inc.
____	____	McCracken, A GUIDE TO FORTRAN PROGRAMMING, John Wiley and Sons
____	____	McCracken, DIGITAL COMPUTER PROGRAMMING, John Wiley and Sons
____	____	McCracken, Weiss & Lee, PROGRAMMING BUSINESS COMPUTERS, John Wiley & Sons
____	____	McMillan & Gonzalez, SYSTEMS ANALYSIS: A COMPUTER APPROACH TO DECISION MODELS, Richard D. Irwin, Inc.
____	____	Naylor & Byrne, LINEAR PROGRAMMING, Wadsworth Publishing Co.
____	____	Nelson & Woods, ACCOUNTING SYSTEMS AND DATA PROCESSING, South-western Publishing Co.
____	____	Optner, SYSTEMS ANALYSIS FOR BUSINESS MANAGEMENT, Prentice-Hall
____	____	Postley, COMPUTERS AND PEOPLE, McGraw-Hill Book Co.
____	____	Randall, Weimer & Greenfield, SYSTEMS AND PROCEDURES FOR AUTOMATED ACCOUNTING, South-Western Publishing Co.
____	____	Robichaud, UNDERSTANDING MODERN BUSINESS DATA PROCESSING, McGraw-Hill Book Co. (Gregg)
____	____	Salmon, IBM MACHINE OPERATION AND WIRING, 2nd Edition, Wadsworth Publishing Co.
____	____	Schmidt & Meyers, ELECTRONIC DATA PROCESSING, Holt Rinehart
____	____	Van Ness, PRINCIPLES OF DATA PROCESSING WITH COMPUTERS, The Business Press
____	____	Van Ness, PRINCIPLES OF PUNCHED CARD DATA PROCESSING, The Business Press
____	____	Wanous & Wanous, DATA PROCESSING OFFICE PRACTICE (Set), South-Western Publishing Co.
____	____	Wrubel, A PRIMER OF PROGRAMMING FOR DIGITAL COMPUTERS, McGraw-Hill Book Co.

IV. PROGRAM COVERAGE

This is a set of course titles that were collected from DP curriculum guides. What do you call the similar course in your school? Write its title in the space provided under the suggested course title. Put an X in the space if any course is not offered in your school.

1. Write the number of the appropriate course title in the blank before the topic.
2. In the space at the bottom of the list of topics, list any other major topic that you cover in your courses, together with the code for the title of the course in which it is presented.

SUGGESTED COURSE TITLES

1. Introduction to DP
2. Unit record systems & eqpt.
3. Intro. to systems analysis
4. DP systems
5. Intro. to digital computers (Comp. theory/logic)
6. Intro. computer programming
7. Advanced programming
8. Programming systems
9. DP applications
0. Field work in DP
X. Data processing math

A. CONCEPTS - Discussion and Presentations About

Functions of key punch	☐	10
" " sorter	☐	11
" " collator	☐	12
" " reproducer . . .	☐	13
" " acctg. machines .	☐	14
Overview of unit-record system	☐	15
History of data processing . .	☐	16
Card layout and design	☐	17
Forms design	☐	18
Procedures development	☐	19
Flow charting	☐	20
Purpose and functions of different languages	☐	21
Assembly programs and compilers	☐	22
Macro-generators	☐	23
Report generators	☐	24
Data scheduling systems . . .	☐	25
Monitors and high level lang.	☐	26
Anal. of information systems.	☐	27
Computer equipment	☐	28
Coding and condensing data .	☐	29
Eval. of auxiliary eqpt. . .	☐	30

Boolean algebra	☐	31
Logic	☐	32
Fixed and floating points	☐	33
Princ/Theory digital computers .	☐	34
Number systems	☐	35
Computer logic	☐	36
Programming essentials	☐	37
Block diagramming	☐	38
Programming systems	☐	39
Central processing unit	☐	40
Registers	☐	41
Uses of symbolic language	☐	42
Computer applications	☐	43
Princ. of data processing	☐	44
______________________	☐	45
______________________	☐	46
______________________	☐	47
______________________	☐	48
______________________	☐	49
______________________	☐	50
______________________	☐	51

1. Introduction to DP
2. Unit record systems & eqpt.
3. Intro. to systems analysis
4. DP systems =
5. Intro. to digital computers (Comp. theory/logic)
6. Intro. computer programming
7. Advanced programming
8. Programming systems
9. DP applications
0. Field work in DP
X. Data processing math

B. SKILLS AND KNOWLEDGES APPLIED

Operate the key punch	☐	10	Plan and punch program card for key punch	☐	30
" " sorter	☐	11	Wire collator control panel . .	☐	31
" " collator	☐	12	Wire reproducer panel	☐	32
" " reproducer	☐	13	Wire acctg. machine panel . . .	☐	33
" " acctg. machine . .	☐	14	Operate computer console . . .	☐	34
Card layout and design	☐	15	Operate card processor	☐	35
Design forms	☐	16	Computer applications	☐	36
Flow charting	☐	17	Loops and indexing	☐	37
Work load evaluation	☐	18	Subroutines	☐	38
Coding and condensing data . .	☐	19	Input-Output controls	☐	39
FORTRAN	☐	20	Programming a tape system . . .	☐	40
COBOL	☐	21	Job timing	☐	41
Autocoder	☐	22	Program random access device .	☐	42
Machine language	☐	23	Debug programs	☐	43
Block diagramming	☐	24	Sort-merge programming	☐	44
Mntng. program library	☐	25	______________	☐	45,6
Mntng. mag tape library	☐	26	______________	☐	47,8
Program instructions	☐	27	______________	☐	4950
Other languages	☐	28,9	______________	☐	51,2

Who runs the students' programs on the computer?

Themselves	☐	1
Person in charge of the computer . .	☐	2
Instructor	☐	3
It is sent to a computer center . . .	☐	4
It isn't run	☐	5
Other ______________	☐	(53-4)

Who runs programs prepared by the teacher for his own use in teaching a class?

Teacher	☐	1
Person in charge of the computer . .	☐	2
It is sent to a computer center . .	☐	3
They aren't run	☐	4
Other ______________	☐	(54-4)

C. Equipment

To what degree are operating skills developed?				What eqpt. did you have when the DP instructional program started? What eqpt. has been added since? When?				Skills and Equipment		How do you provide equipment for students' use?						What arrangements do you have for maintenance of eqpt?	
10	11	12	13	14-15	16	17-18	19			20	21-25	26-29	30-33	34	35	36-7	38-41
General Knowledge About	Knowledge re applications	Acquaintanceship (hands on)	Voc'l. Skill	Bgng. of Prgm.		Added			Cd. No.	Gift	Purchase (Amt/$)	Lease (Amt/mo.)	Rent (Amt/mo.)	Use eqpt. in adm. offices	Use eqpt. in bus. downtown	On call (Amt/hr)	Service Contract (Amt/mo.)
42	43	44	45	46	47-8	49-51	52			53	53-57	58-61	62-65	66	67	68-9	70-73
				No.	Yr.												
								Key punch simulator	3								
								Key punch	3								
								Verifier	4								
								Acctg. (tab) machines	4								
								Interpreter	5								
								Collator	5								
								Reproducer	6								
								Sorter	6								
								Computer	7								
								Card processor	7								
								Tape drive	8								
								Data converter	8								
								Random Access Dev.	9								
								Printer	9								
								Programming	10								

APPENDIX B - 5

Data Processing School Census Survey Questionnaire

UNIVERSITY OF COLORADO NATIONAL SURVEY
INSTRUCTIONAL PROGRAMS IN DATA PROCESSING

ID NO. 84038

FOR UNIVERSITY USE ONLY
DO NOT MARK OR WRITE IN THIS AREA

0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9

TYPE OF SCHOOL HS JC VOC

USE NO. 2 PENCIL MAKE YOUR MARKS HEAVY AND BLACK.
ERASE COMPLETELY ANY MARK YOU WISH TO CHANGE.

1. INDICATE THE NUMBER OF STUDENTS PRESENTLY ENROLLED IN --

HIGH SCHOOL (GR. 10--12)	JUNIOR COLLEGE / VOCATIONAL	ADULT EVENING EDUCATION
LESS 299	LESS 299	LESS 299
300 599	300 599	300 599
600 999	600 999	600 999
1000 1499	1500 4999	1000 1499
1500 UP	5000 UP	1500 UP

2. DOES YOUR SCHOOL PRESENTLY OFFER COURSES IN AUTOMATED DATA PROCESSING ? YES NO

3. DO YOU ANTICIPATE THAT YOUR SCHOOL WILL OFFER SUCH COURSES WITHIN THE NEXT THREE YEARS ? -- IF YOUR ANSWER TO THIS QUESTION IS "NO", YOU HAVE COMPLETED THIS QUESTIONNAIRE. YES NO

4. WHICH DEPARTMENT(S) HAVE / WILL HAVE RESPONSIBILITY FOR DATA PROCESSING INSTRUCTION AND EQUIPMENT (IF OTHER, INDICATE IN REMARKS)

	BUS	MATH	SCI	ENGR	OTHER
INSTRUCTIONAL COURSES					
EQUIPMENT CONTROL					

5. DATA PROCESSING COURSES ARE / WILL BE OFFERED TO --

HIGH SCHOOL STUDENTS, GRADES 10 11 12

POST HIGH SCHOOL STUDENTS

ADULT EVENING CLASSES

DATA PROCESSING COURSES ARE / WILL BE OFFERED AS --

UNIT IN ANOTHER CLASS SEPARATE SEQUENCE OF CLASSES

6. NUMBER OF STUDENTS ENROLLED IN COURSES COVERING DATA PROCESSING SUBJECTS --

HIGH SCHOOL
200 100 80 40 20 10 8 4 2 1

POST HIGH SCHOOL
200 100 80 40 20 10 8 4 2 1

ADULT EVENING CLASSES
200 100 80 40 20 10 8 4 2 1

7. WHAT AREAS OF STUDY ARE / WILL BE COVERED IN YOUR DATA PROCESSING PROGRAM(S)?

KNOWLEDGES / THEORY

- UNIT RECORD SYSTEM
- INTRODUCTION TO DATA PROCESSING
- DATA PROCESSING APPLICATIONS
- INTRODUCTION TO SYSTEMS
- SYSTEMS ANALYSIS
- MATH (BOOLEAN ALGEBRA, SET THEORY, ETC.)
- NUMBER SYSTEMS (BINARY, OCTAL, ETC.)
- DIGITAL COMPUTER THEORY/LOGIC
- OTHER (NOTE IN REMARKS)

SKILLS — DEGREE OF SKILL

	INTRODUCTION/FAMILIARIZATION	VOCATIONAL SKILL	WIRING
KEY PUNCH/VERIFIER			
SORTER			
REPRODUCER			
INTERPRETER			
COLLATOR			
PAPER TAPE EQUIPMENT			
ACCOUNTING MACHINES (TABULATORS)			
COMPUTER CONSOLE			
COMPUTER PROGRAMS (INDICATE LANGUAGES TAUGHT IN REMARKS)			
OTHER (NOTE IN REMARKS)			

8. INDICATE THE NUMBER OF PIECES OF EQUIPMENT YOUR SCHOOL HAS AVAILABLE FOR INSTRUCTIONAL PURPOSES.

KEY PUNCH 10 8 4 2 1
KEY PUNCH SIMULATOR 10 8 4 2 1
VERIFIER 10 8 4 2 1
SORTER 10 8 4 2 1
COLLATOR 10 8 4 2 1
INTERPRETER 10 8 4 2 1
REPRODUCER 10 8 4 2 1
ACCOUNTING MACHINES 10 8 4 2 1
PAPER TAPE EQUIPMENT 10 8 4 2 1
RANDOM ACCESS DEVICES 10 8 4 2 1
COMPUTER 10 8 4 2 1

INDICATE MFG. AND MODEL IN REMARKS.

9. INDICATE THE NUMBER OF HIGH SCHOOLS WHICH TEACH DATA PROCESSING AND LIST THEM ON THE BACK OF THIS SHEET.
200 100 80 40 20 10 8 4 2 1

10. INDICATE THE NUMBER OF SCHOOLS WHICH HAVE DATA PROCESSING EQUIPMENT AVAILABLE FOR INSTRUCTIONAL USE.
200 100 80 40 20 10 8 4 2 1

1	2	3	4	5	6	7	8	9	0
1	2	3	4	5	6	7	8	9	0
1	2	3	4	5	6	7	8	9	0
1	2	3	4	5	6	7	8	9	0

REMARKS:

7. KNOWLEDGES:

PROGRAM LANGUAGES:

8. COMPUTER MANUFACTURER(S):

SKILLS:

(USE BACK OF SHEET FOR ADDITIONAL REMARKS)

IBM H93878

APPENDIX B - 6

Nonstructured Interview Guide for Management Personnel Of Manufacturers of Data Processing Equipment (Computers and Peripheral Equipment)

Nonstructured Interview Guide for Management Personnel of Manufacturers of Data Processing Equipment (Computers and Peripheral Equipment)

The nonstructured interview with management personnel of manufacturers of data processing equipment was conducted to cover the following points of information:

I. Developments of data processing equipment and procedures during the next three to ten years.

  a. Hardware
  b. Input/Output
  c. Software

2. Effect of these developments on:

  a. Procedures and systems in business
  b. The following jobs:
    Key punch
    Unit record equipment operators
    Computer console operators
    Programmers
    Systems analysts
  c. Emergence of new jobs in the field
  d. The educational preparations of the people holding the above and other data processing jobs

APPENDIX C

APPENDIX C - 1

Data Processing Research Interviewers

Mrs. Caroline J. Beckner
Casey Junior High School
Boulder, Colorado

Mr. John Bell
University of Colorado
Boulder, Colorado

Mr. Anthony S. Dinovelli
Middletown, Connecticut

Mrs. Stuart Dunbar
Brookline High School
Brookline, Massachusetts

Miss Mina M. Johnson
San Francisco State College
San Francisco, California

Mr. Bill Korn
Colorado State University
Fort Collins, Colorado

Miss Doris Leidheisl
Kenosha Technical Institute
Kenosha, Wisconsin

Miss Barbara J. Minnick
University of Tennessee
Knoxville, Tennessee

Mr. Robert R. Mueller
Wichita State University
Wichita, Kansas

Mrs. Joyce D. Mueller
University of Nebraska
Lincoln, Nebraska

Mrs. Juanita J. Waters
Springfield High School
Springfield, Oregon

Mrs. Donna Fae Redinbaugh
University of Nebraska
Lincoln, Nebraska

Miss Virginia C. Williams
St. Cloud State College
St. Cloud, Minnesota

Miss Alice Yetka
Colorado State College
Greeley, Colorado

APPENDIX C - 2

Businesses Interviewed

NAME OF COMPANY	CITY AND STATE	SIC
New England Region		
Aetna Life & Casualty Insurance Co.	Hartford, Conn.	6300
Connecticut Mutual Life	Hartford, Conn.	6300
Travelers Insurance Co.	Hartford, Conn.	6300
Meriden Savings Bank	Meriden, Conn.	6000
Fabnir Bearing Co.	New Britain, Conn.	3562
Fenn Manufacturing Co.	New Britain, Conn.	3591
New Britain Machine Co.	New Britain, Conn.	3729
Stanley Works	New Britain, Conn.	2851
Burndy Corp.	Norwalk, Conn.	3611
DeLeo Brothers, Inc.	Stamford, Conn.	1794
Colonial Bank & Trust Co.	Waterbury, Conn.	6000
Society for Savings	West Hartford, Conn.	6000
Boston Edison Co.	Boston, Mass.	4911
Boston Gas & Co.	Boston, Mass.	4922
Carter Rice Storrs	Boston, Mass.	5096
Christian Science Publishing Co.	Boston, Mass.	2731
Colonial Provision Co.	Boston, Mass.	2013
Gilette Safety Razor Co.	Boston, Mass.	3421
Houghton Mifflin Co.	Boston, Mass.	2731
Liberty Mutual Fire Insurance	Boston, Mass.	6300
New England Telephone & Telegraph Co.	Boston, Mass.	4811
Old Colony Trust Co.	Boston, Mass.	6000
Savings Bank Life Insurance	Boston, Mass.	6300
United Shoe Machinery Co.	Boston, Mass.	3559
The Automobile Legal Association	Brighton, Mass.	8699
Plymouth County Electric	Cambridge, Mass.	4911
Carter's Ink Co.	Cambridge, Mass.	2899
Morse Shoe Inc.	Canton, Mass.	5039
Norfolk & Dedham Mutual Fire Ins.	Dedham, Mass.	6300
Champion Lamp Works, Inc.	Lynn, Mass.	3641
Milton Savings Bank	Milton, Mass.	6000
William Carter Company	Needham Heights, Mass.	2321
Lushon Plastics	Newton Highlands, Mass.	3079
Empire Clothing Company	Salem, Mass.	5651
B. F. Goodrich Footwear Co.	Watertown, Mass.	2399
Stanley Home Products, Inc.	Westfield, Mass.	3981
Middle Atlantic Region		
Fedway Associates, Inc.	Jersey City, N.J.	5095
Lightolier, Inc.	Jersey City, N.J.	5063
Realtone Electronics Corp.	Jersey City, N.J.	3651
American Flange & Manufacturing Co.	Linden, N.J.	3499

Appendix C-2 continued

Beattie Manufacturing Co.	Little Falls, N.J.	2271
New Jersey Power & Light	Morristown, N.J.	4911
Englehard Industry, Inc.	Newark, N.J.	2819
Federal Pacific Electric Co.	Newark, N.J.	3622
Howell Electric Motors Co.	Plainfield, N.J.	3621
Middlesex Water Co.	Woodbridge, N.J.	4941
R. Hoe & Co.	Bronx, N.Y.	3555
Trunz, Inc.	Brooklyn, N.Y.	2011
Niagara Machine & Tool Works	Buffalo, N.Y.	3548
Climax Manufacturing Co.	Castorland, N.Y.	2651
Mohawk Paper Mills Inc.	Cohoes, N. Y.	2621
Alcoa Steamship Co.	New York, N.Y.	4421
Allied Chemical Corp.	New York, N.Y.	2821
Bowery Savings Bank	New York, N.Y.	6000
Columbia Gas System, Inc.	New York, N.Y.	4923
Crompton-Richmond Co.	New York, N.Y.	6153
Diamond Automation, Inc.	New York, N.Y.	3551
Dry Dock Savings Bank	New York, N.Y.	6000
General Cable Co.	New York, N.Y.	3351
General Cigar Co.	New York, N.Y.	5094
Givaudan Corp.	New York, N.Y.	2899
Johns-Manville Sales Corp.	New York, N.Y.	5098
National Screen Service Corp.	New York, N.Y.	3861
New York Stock Exchange	New York, N.Y.	6231
Pan American Airways	New York, N.Y.	4511
Roamans, Inc.	New York, N.Y.	5621
Shapiro Paper Co.	New York, N.Y.	5096
Smith Barney & Co.	New York, N.Y.	6211
Texas Gulf Sulphur Co.	New York, N.Y.	1477
Tri Continental Corp.	New York, N.Y.	6723
Ward Foods, Inc.	New York, N.Y.	2051
John Wiley Sons, Inc.	New York, N.Y.	2731
Witco Chemical Co.	New York, N.Y.	2841
World Journal Tribune, Inc.	New York, N.Y.	2711
Continental Baking Co.	Rye, N.Y.	2051
Roosevelt Raceway, Inc.	Westbury, N.Y.	7948
Fanny Farmer Candy Shops	Rochester, N.Y.	2071
Marine Midland Trust	Rochester, N.Y.	6000
Rochester Savings Bank	Rochester, N.Y.	6000
Kawecki Chemical Co.	Boyertown, Pa.	2819
Paterson Parchment Paper Co.	Bristol, Pa.	3955
National Forge Co.	Irvine, Pa.	3312
Educators Mutual Life Insurance	Lancaster, Pa.	6300
Talon, Inc.	Meadville, Pa.	3361
Globe Ticket Co.	Philadelphia, Pa.	2751
Leeds & Northrup Co.	Philadelphia, Pa.	3611

Appendix C-2 continued

Pincus, Bernard & Co.	Philadelphia, Pa.	2013
Publicker Industries, Inc.	Philadelphia, Pa.	2085
Strawbridge & Clothier	Philadelphia, Pa.	5311
Wellington Management	Philadelphia, Pa.	6281
Yarnall-Waring Co.	Philadelphia, Pa.	3494
American General Life Insurance	Pittsburgh, Pa.	6300
Equitable Gas Co.	Pittsburgh, Pa.	2818
Papercraft Corp.	Pittsburgh, Pa.	2641
Swanee Paper Corp.	Ransom, Pa.	2621
Miners National Bank	Wilkes-Barre, Pa.	6000

South Atlantic Region

Southern Bell Telephone & Telegraph Co.	Coral Gables, Fla.	4811
Colebrook, Inc.	Hialeah, Fla.	2253
Computer Service of Florida	Miami, Florida	7392
First Federal Savings and Loan	Miami, Florida	6000
Kelly Tractor Co.	Miami, Florida	5252
American Pioneer Life Insurance	Orlando, Fla.	6300
Minute Maid Co.	Orlando, Fla.	2037
Tela-a-Data	Miami, Florida	7392
Maas Brothers, Inc.	Tampa, Fla.	5311
Tampa Electric Co.	Tampa, Fla.	4911
Walter Jim Corp.	Tampa, Fla.	1511
Times Publishing Co.	St. Petersburg, Fla.	2711

Shirley of Atlanta, Inc.	Atlanta, Ga.	2321
Oxford Chemical Corp.	Chamblee, Ga.	2842

Baltimore Paint Chemical Corp.	Baltimore, Md.	2851
Churchill, Ltd.	Baltimore, Md.	5095
Fair Lanes, Inc.	Baltimore, Md.	7931
Sun Life Insurance Company of America	Baltimore, Md.	6300
Victor Products, Corp.	Hagerstown, Md.	3581

Package Products Co.	Charlotte, N.C.	2752
Central Caroline Bank & Trust	Durham, N.C.	6000
Broyhill Furniture Industries	Lenoir, N. C.	2511
Mount Olive Pickle Co.	Mount Olive, N.C.	2035
Laurel Mills, Inc.	Rutherfordton, N.C.	2221
Timme Corp.	Wilmington, N.C.	2211

Keltec Industries, Inc.	Alexandria, Va.	7391
Lane Co.	Altavista, Va.	2511
Marion-Harwood Manufacturing Corp.	Marion, Va.	2322

Sterling Faucet Co.	Morgantown, W. Va.	3431
Bank of Commerce	Washington, D.C.	6000

Appendix C-2 continued

East South Central Region

Birmingham Trust National Bank	Birmingham, Ala.	6000
Cobbs, Allen & Hall, Inc.	Birmingham, Ala.	6300
Liberty National Life Insurance Co.	Birmingham, Ala.	6300
Southern Natural Gas Co.	Birmingham, Ala.	1381
Walker Drug Co.	Birmingham, Ala.	5022
Belknap Hardware & Manufacturing Co.	Louisville, Ky.	5072
Thomas Industries	Louisville, Ky.	3553
Spartus, Corp.	Louisville, Miss.	3871
Allen Bros. & O'Hara, Inc.	Memphis, Tenn.	1511
Cook & Co.	Memphis, Tenn.	5051
Memphis Light, Gas, & Water Division	Memphis, Tenn.	4931

West South Central Region

First Pyramid Life Insurance Co.	Little Rock, Ark.	6300
Louisiana Power & Light	Gretna, La.	4911
Petroleum Helicopter, Inc.	Lafayette, La.	4521
F. Strauss & Son, Inc.	Monroe, La.	5042
American Creosote Works	New Orleans, La.	2491
Holsum Bakeries Inc.	New Orleans, La.	2051
Royal Street Corp.	New Orleans, La.	4832
City National Bank & Trust Co.	Oklahoma City, Okla.	6000
First National Bank of Midwest	Oklahoma City, Okla.	6000
Western Security Life	Oklahoma City, Okla.	6152
Jones and Laughlin, Supply Division	Tulsa, Okla.	3312
Oral Roberts Co.	Tulsa, Okla.	8661
Sinclair Oil	Tulsa, Okla.	1311
Skelly Oil	Tulsa, Okla.	1311
Southern Farm Supply Association Inc.	Amarillo, Tex.	2819
Goodpasture Grain & Mill	Brownfield, Tex.	5051
Core Labs, Inc.	Dallas, Tex.	8911
Rauscher Pierce Security Corp.	Dallas, Tex.	6211
Southwest Wheel & Manufacturing Co.	Dallas, Tex.	5013
Sun Oil Co.	Dallas, Tex.	1311
Universal Life & Accident	Dallas, Tex.	6300
El Paso Natural Gas	El Paso, Tex.	4922
Hicks-Ponder Co.	El Paso, Tex.	2321
Newspaper Printing Corp.	El Paso, Tex.	2751
Popular Department Store	El Paso, Tex.	5311
Whyburn & Co.	El Paso, Tex.	6300

Appendix C-2 continued

First National Bank	Ft. Worth, Tex.	6000
International Service Life	Ft. Worth, Tex.	6300
Kimbell Milling Co.	Ft. Worth, Tex.	4221
Southwestern Petroleum Co.	Ft. Worth, Tex.	1311
Fish Engineering Corp.	Houston, Tex.	8911
Houston Chronicle Publishing Co.	Houston, Tex.	2711
McDonnell Automation Center	Houston, Tex.	7399
Schlumberger Well Survey	Houston, Tex.	1382
Tidewater Oil Co.	Houston, Tex.	1311
Permian Mud Service Inc.	Odessa, Tex.	4922
H. B. Zachry	San Antonio, Tex.	1511
National Bank of Commerce	San Antonio, Tex.	6000
Pearl Brewery	San Antonio, Tex.	2082
Roegelein Provision Co.	San Antonio, Tex.	2011
Santa Rosa Medical Center	San Antonio, Tex.	8011
Texas City National Bank	Texas City, Tex.	6000

West North Central Region

Meredith Publishing Co.	Des Moines, Iowa	2731
Western Mutual Insurance	Des Moines, Iowa	6300
Maytag	Newton, Iowa	3633

Boeing Airplane Co.	Wichita, Kan.	3569
Cessna Air Craft	Wichita, Kan.	3569
Coleman Co.	Wichita, Kan.	3567
Garvey, Inc.	Wichita, Kan.	6711
Rock Island Oil & Refining Co.	Wichita, Kan.	0139
Commercial National Bank	Kansas City, Kan.	6000

Minnesota Power & Light	Duluth, Minn.	4911
Gambles-Scogmore	Minneapolis, Minn.	5331
Gray Co.	Minneapolis, Minn.	3586
Investors Diversified Society	Minneapolis, Minn.	6799
Maico Electronics Inc.	Minneapolis, Minn.	3842
Ed. Phillips & Sons, Co.	Minneapolis, Minn.	5095
United Hardware Distributor Co.	Minneapolis, Minn.	5072
Minnesota Transfer Railway	St. Paul, Minn.	4013
Paper, Calmenson & Co.	St. Paul, Minn.	5091
West Publishing Co.	St. Paul, Minn.	2731

Century Refining Co.	Kansas City, Mo.	2911
Chemagro Corp.	Kansas City, Mo.	2873
Old American Insurance Co.	Kansas City, Mo.	6300
Old Security Life Insurance Co.	Kansas City, Mo.	6300
Townley Metal & Hardware	Kansas City, Mo.	5072
Traders National Bank	Kansas City, Mo.	6000
Asby Corp.	St. Louis, Mo.	3317

Appendix C-2 continued

Biltwell Co.	St. Louis, Mo.	2327
Laclede Steel Co.	St. Louis, Mo.	3312
Nooter Corp.	St. Louis, Mo.	3443
Site Oil Company of Missouri	St. Louis, Mo.	5092
Western Textile Products	St. Louis, Mo.	2211
J. L. Brandeis & Sons	Omaha, Nebr.	5311
Hinky Dinky Stores	Omaha, Nebr.	5411
Commercial Savings & Loan	Omaha, Nebr.	6000
Glauber Valve Co.	Omaha, Nebr.	3494
West Central Service Bureau	Omaha, Nebr.	7392

East North Central Region

Alter, Harry Co.	Chicago, Ill.	5077
Cenco Instruments Corp.	Chicago, Ill.	5086
Follett Corp.	Chicago, Ill.	2731
McDonnell & Miller, Inc.	Chicago, Ill.	3494
Mid City National Bank	Chicago, Ill.	6000
Miehle-Gass-Dexter, Inc.	Chicago, Ill.	3555
Walter E. Selck & Co.	Chicago, Ill.	3431
Tempel Steel Co.	Chicago, Ill.	3461
Verson Allsteel Press Co.	Chicago, Ill.	3559
William Wrigley, Jr., Co.	Chicago, Ill.	2073
Alberto-Culver Co.	Melrose Park, Ill.	2844
Baxter Laboratories	Morton Grove, Ill.	2834
Peoria & Pekin Union Railway	Peoria, Ill.	4011
Eclipse Fuel Engineering	Rockford, Ill.	3433
Zion Industries, Inc.	Zion, Ill.	2051
Cummins Engine Co.	Columbus, Ind.	3519
Nibco, Inc.	Elkhart, Ind.	3494
Balcamp, Inc.	Indianapolis, Ind.	5013
Central Rubber & Supply	Indianapolis, Ind.	5089
Economy Finance Corp.	Indianapolis, Ind.	6145
Midwestern United Life Insurance Co.	Indianapolis, Ind.	6300
U. S. Corrug-Fibre Box	Indianapolis, Ind.	2653
Lafayette Life Insurance Co.	Lafayette, Ind.	6300
Citizens Bank of Michigan	Michigan City, Ind.	6000
Ford Motor Co.	Dearborn, Mich.	3711
American Natural Gas Service Co.	Detroit, Mich.	1311
Bulldog Electric Products	Detroit, Mich.	3613
Chrysler Corp.	Detroit, Mich.	3711
Coon-DeVisser Co.	Detroit, Mich.	5082
J. L. Hudson Co.	Detroit, Mich.	5311
Parke-Davis & Co.	Detroit, Mich.	2831
R. L. Polk & Co.	Detroit, Mich.	7331

Appendix C-2 continued

Rockwell Standard	Detroit, Mich.	3714
B. Siegel Co.	Detroit, Mich.	5621
East Jordon Iron Works	East Jordon, Mich.	3321
Bissell, Inc.	Grand Rapids, Mich.	3589
Saginaw Transfer, Co.	Saginaw, Mich.	4213
Tecumseh Products Co.	Tecumseh, Mich.	3585
Gar Wood Industries, Inc.	Wayne, Mich.	3713
Alside, Inc.	Akron, Ohio	3444
RCA Rubber Co.	Akron, Ohio	3069
Dave Towell, Inc.	Akron, Ohio	5511
Pecco Products	Bedrod, Ohio	3722
Seaway Foods	Bedford, Ohio	5042
Billboard Publishing Co.	Cincinnati, Ohio	2721
Mack Shirt Corp.	Cincinnati, Ohio	2321
Addressograph-Multigraph	Cleveland, Ohio	3579
Anchor Motor Freight, Inc.	Cleveland, Ohio	4213
Barth Corp.	Cleveland, Ohio	3548
Glastic Corp.	Cleveland, Ohio	3079
Grabler Manufacturing Co.	Cleveland, Ohio	3498
Jay F. Zook, Inc.	Cleveland, Ohio	6611
Joseph & Feiss Co.	Cleveland, Ohio	2311
Laub Baking Co.	Cleveland, Ohio	2051
Lewis Welding & Engineering Corp.	Cleveland, Ohio	3531
Ohio Crankshaft Co.	Cleveland, Ohio	3391
Ohio Machine Co.	Cleveland, Ohio	5082
Warner & Swasey Co.	Cleveland, Ohio	3541
Zell Co.	Cleveland, Ohio	5042
Buckeye Steel Castings Co.	Columbus, Ohio	3323
Columbus Plastic Products, Inc.	Columbus, Ohio	3079
Nationwide Mutual Insurance Co.	Columbus, Ohio	6300
North American Equitable Life	Columbus, Ohio	6300
North Electric Co.	Galion, Ohio	3661
American Society for Metals	Novelty, Ohio	2721
Bunting Brass & Bronze Co.	Toledo, Ohio	3566
Champion Spark Plug Co.	Toledo, Ohio	3694
DeVilbiss Co.	Toledo, Ohio	3561
Ohio Citizens Trust Co.	Toledo, Ohio	6000
Owens-Corning Fiberglass	Toledo, Ohio	3296
Toledo Scale Corp.	Toledo, Ohio	3576
Nynes Steel Co.	Youngstown, Ohio	3441
Standard Slag Co.	Youngstown, Ohio	3295
Albert Trostel & Sons Co.	Milwaukee, Wis.	3111
First Wisconsin National Bank	Milwaukee, Wis.	6000
Harley-Davidson Motor Co.	Milwaukee, Wis.	3751
Lakeside Bridge & Steel Co.	Milwaukee, Wis.	3443
Northwestern Mutual Life	Milwaukee, Wis.	6300

Appendix C-2 continued

Milwaukee Western Bank	Milwaukee, Wis.	6000
Wisconsin Centrifugal Foundry	Waukesha, Wis.	3362

Mountain Region

Apache Railway Co.	Phoenix, Ariz.	4011
Institute of Financial Planning	Phoenix, Ariz.	6711
The Valley National Bank	Phoenix, Ariz.	6000
Western Cotton Products	Phoenix, Ariz.	4221
Salt River Project	Tempe, Ariz.	4971
Shamrock Dairy Inc.	Tucson, Ariz.	5043
Central Bank & Trust Co.	Denver, Colo.	6000
Frontier Airlines	Denver, Colo.	4511
Ringsby Truck Lines, Inc.	Denver, Colo.	4213
Sigman Meat	Denver, Colo.	2011
Silver Steel Distributor	Denver, Colo.	5091
Smith-Brooks Printing Co.	Denver, Colo.	2751
Mountain States Wholesale	Boise, Ida.	5042
First National Bank of Nevada	Reno, Nev.	6000
Carlsbad National Bank	Carlsbad, N. Mex.	6000
Electronic Processing Corp.	Albuquerque, N. Mex.	7392
Linely Equipment Co.	Albuquerque, N. Mex.	5999
Shoprite Foods	Albuquerque, N. Mex.	5411
Kearns Tribune Corp.	Salt Lake City, Utah	2711

Pacific Region

Cutter Laboratories Inc.	Berkeley, Cal.	2831
Giannini Controls Corp.	Duarte, Cal.	3811
Farmers Merchants Bank	Long Beach, Cal.	6000
A-1 Kotzin Co.	Los Angeles, Cal.	2327
Adel Division-General Metals Corp.	Los Angeles, Cal.	3729
Gallenkamp Stores Co.	Los Angeles, Cal.	5665
International Industries	Los Angeles, Cal.	5812
Mandel's of California	Los Angeles, Cal.	5663
Pierce National Life Insurance Co.	Los Angeles, Cal.	6300
Rexall Drug & Chemical Co.	Los Angeles, Cal.	5022
Stratham Instruments Inc.	Los Angeles, Cal.	3811
Union Bank	Los Angeles, Cal.	6000
Warner Bros. Pictures Inc.	Los Angeles, Cal.	7811
Hycon Manufacturing Co.	Monronia, Cal.	3861
Central Valley National Bank	Oakland, Cal.	6000
Rhodes Department Store	Oakland, Cal.	5311

Appendix C-2 continued

Stolte Inc.	Oakland, Cal.	1511
World Airways, Inc.	Oakland, Cal.	4511
Sunkist Growers, Inc.	Ontario, Cal.	0122
Crystal Cream & Butter Co.	Sacramento, Cal.	2021
H. S. Crocker Co.	San Bruno, Cal.	2651
City Transit Systems	San Diego, Cal.	4151
International Distributor Co.	San Diego, Cal.	5099
Snowflake Baking Co.	San Diego, Cal.	2051
U. S. National Bank	San Diego, Cal.	6000
California Automobile Association	San Francisco, Cal.	6300
D. N. & E. Walter & Co.	San Francisco, Cal.	5097
Fibreboard Paper Products	San Francisco, Cal.	2952
Joseph Magnin Co.	San Francisco, Cal.	5621
States Steamship Co.	San Francisco, Cal.	4411
Wells Fargo Bank	San Francisco, Cal.	6000
Oregon Mutual Insurance	McMinnville, Ore.	6300
Esco Corp.	Portland, Ore.	3323
First National Bank of Oregon	Portland, Ore.	6000
Mail-Well Envelope Co.	Portland, Ore.	2642
Oregon Bank	Portland, Ore.	6000
Alaska Steamship Co.	Seattle, Wash.	4421
Seattle Trust & Savings Bank	Seattle, Wash.	6000
Montana Phosphate Product	Spokane, Wash.	1475

Appendix C, Table C-3. Distribution of Types of Businesses by Geographic Location and SIC Classification

Type of Business	Geographic Location									Totals
	New England	Middle Atlantic	South Atlantic	East-So. Central	West-So. Central	West-No. Central	East-No. Central	Mountain	Pacific	
Agriculture Forestry-Fisheries						1			1	2
Mining-Oil		1		1	6		1		1	10
Contract Construction	1		1	1	1				1	5
Manufacturers	15	33	16	2	9	16	53	3	11	158
Transportation		2			2	1	3	4	4	16
Communication	1		1		1			1		4
Public Utilities	3	3	1	1	3	1				12
Wholesalers	2	5	1	4	3	5	8	3	4	35
Retailers	1	2	2		1	3	3	2	5	19
Banking & Finance	5	9	3	1	7	3	6	4	8	46
Insurance	6	2	2	2	4	3	5		3	27
Real Estate		2				2	1	1		6
Services	1	1	3		5	1		1	1	13
Totals	35	60	30	12	42	36	80	19	39	353

APPENDIX C-4

HIGH SCHOOLS, VOCATIONAL-TECHNICAL SCHOOLS AND JUNIOR COLLEGES INTERVIEWED*

High Schools

- Norwich, Connecticut
  - Norwich Free Academy
- Chicopee, Massachusetts
  - Chicopee High School
- Dracut, Massachusetts
  - Public Schools
- Holliston, Massachusetts
  - Public Schools
- Shrewsbury, Massachusetts
  - Shrewsbury High School
- Raritan, New Jersey
  - Bridgewater Raritan High School
- Ocean Grove, New Jersey
  - Neptune Township Schools
- Princeton, New Jersey
  - Princeton High School
- Springfield, New Jersey
  - Union County Regional High School
- Chester, New Jersey
  - West Morris Regional High School
- Albany, New York
  - Public Schools
- Buffalo, New York
  - Hutchinson Central Technical High School
  - East High School
- Buffalo, New York (continued)
  - Bennett High School
  - South Park High School
- Elmsford, New York
  - Public Schools
- Franklin Square, New York
  - Sewanhaka Schools
- Freeport, New York
  - Freeport High School
- Levittown, Long Island, New York
  - Division Avenue High School
- Mamaroneck, New York
  - Public Schools
- Mount Vernon, New York
  - Mount Vernon High School
- New York, New York
  - Central Community High School, Queens
  - Martin Van Buren High School, Queens
  - Maxwell Vocational High School, Brooklyn
- Port Washington, New York
  - Port Washington Public Schools
- Rochester, New York
  - Ben Franklin High School
  - East High School
- Yonkers, New York
  - High School of Commerce

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*Questionnaires from 72 high schools, 32 vocational-technical schools, and 72 junior colleges were usable.

High Schools (continued)

Pittsburgh, Pennsylvania
  Allegany Public Schools

Wilkes Barre, Pennsylvania
  Meyers High School

Miami, Florida
  Miami Central High School

Hagerstown, Maryland
  Washington County Schools

Charlotte, North Carolina
  Charlotte-Mecklenberg
    Public Schools

Fairfax, Virginia
  Fairfax County Schools

Louisville, Kentucky
  Jefferson County Schools
  City Schools

Memphis, Tennessee
  City School System

Little Rock, Arkansas
  Public Schools

Dallas, Texas
  Crozier High School

El Paso, Texas
  El Paso Independent School

Fort Worth, Texas
  Fort Worth Public Schools

Houston, Texas
  Public Schools
  Spring Branch High School

Pasadena, Texas
  Public Schools

San Antonio, Texas
  Northeast Independent School
    District

Des Moines, Iowa
  Des Moines Public Schools

Wichita, Kansas
  Wichita High Schools

Kansas City, Missouri
  Public Schools

St. Louis, Missouri
  O'Fallon Technical School

Chicago, Illinois
  Public Schools

Peoria, Illinois
  Public Schools

Rockford, Illinois
  Rockford Public Schools

Waukegan, Illinois
  Waukegan Township High School

Michigan City, Indiana
  Elston Senior High School

Warsaw, Indiana
  Warsaw Community High School

Detroit, Michigan
  Cass Technical High School

Jackson, Michigan
  Public Schools

Pontiac, Michigan
  Waterford Public High School

Akron, Ohio
  Akron Public Schools

Cincinnati, Ohio
  Cincinnati Public Schools

Cleveland, Ohio
  Cleveland Public Schools

High Schools (continued)

Columbus, Ohio
Hamilton Local School District

Dayton, Ohio
Patterson Co-op High School

Parma, Ohio
Parma School District

Whitehall, Ohio
Whitehall High School

Phoenix, Arizona
Phoenix Union High School

Tucson, Arizona
Tucson High School

Englewood, Colorado
Englewood High School

Lakewood, Colorado
Jefferson County Public Schools

Reno, Nevada
Reno High School

Albuquerque, New Mexico
Public Schools

Chula Vista, California
Sweetwater Union High School

Sacramento, California
Luther Burbank High School

San Diego, California
San Diego Public Schools

Vocational-Technical Schools

Hartford, Connecticut
Hartford State Technical Institute

Norwalk, Connecticut
Norwalk State Technical Institute

Arlington, Massachusetts
Technical High School

Buffalo, New York
Erie County Technical Institute

Westbury, New York
Nassau County Technical and Trade Training Center

Monroeville, Pennsylvania
Forbes Trail Area Technical School

Philadelphia, Pennsylvania
Dobbins Technical High School
Mastbaum Technical High School

Scranton, Pennsylvania
Scranton Technical School

Miami, Florida
Lindsey-Hopkins Adult Education Center

Tampa, Florida
Brewster Vocational School

Atlanta, Georgia
Hoke Smith Technical School

Clarkston, Georgia
DeKalb Area Technical School

Vocational-Technical Schools (continued)

Marietta, Georgia
  Marietta-Cobb County Area
    Vocational-Technical School

Goldsboro, North Carolina
  Wayne Technical Institute

Raleigh, North Carolina
  Holding Technical Institute

Bessemer, Alabama
  Bessemer State Technical School

Birmingham, Alabama
  Wenonah State Technical
    Trade School

Gretna, Louisiana
  Jefferson Parish Vocational
    Technical School

West Monroe, Louisiana
  Quachita Valley Vocational
    Technical School

Oklahoma City, Oklahoma
  Vocational Technical Public
    Schools

Tulsa, Oklahoma
  Area Vocational Technical
    School

Duluth, Minnesota
  Vocational Technical School

Minneapolis, Minnesota
  Vocational Education,
    Minneapolis Public Schools

St. Paul, Minnesota
  St. Paul Technical
    Vocational Institute

Indianapolis, Indiana
  Area Vocational
    Technical Education

South Bend, Indiana
  Adult Educational Division of
    South Bend Community Schools

Columbus, Ohio
  Columbus Area Technical School

Perrysburg, Ohio
  Pento-County Vocational
    School and Technical College

Willoughby, Ohio
  Chandler Technical School

Waukesha, Wisconsin
  Vocational-Technical School

Denver, Colorado
  Opportunity School

Seattle, Washington
  Edison Technical School

Junior/Community Colleges

Norwalk, Connecticut
  Norwalk Community College

New York, New York
  Bronx Community College
  Brooklyn Community College
  Manhattan Community College

Cobleskill, New York
  State University of New York
    Agricultural and Technical
    College

Farmingdale, Long Island, New York
  State University of New York
    Agricultural and Technical Institute

Junior/Community Colleges (continued)

Rochester, New York
  Monroe Community College

Suffolk, New York
  Suffolk County Community College

Valhalla, New York
  Westchester Community College

Watertown, New York
  Jefferson Community College

York, Pennsylvania
  York Junior College

Bradenton, Florida
  Manatic Junior College

Clearwater, Florida
  St. Petersburg Junior College

Ft. Lauderdale, Florida
  Broward County Junior College

Miami, Florida
  Miami-Date Junior College

Baltimore, Maryland
  Baltimore Junior College

Cantonsville, Maryland
  Cantonsville Community College

Hagerstown, Maryland
  Hagerstown Junior College

Smitland, Maryland
  Prince George's Community College

Charlotte, North Carolina
  Central Piedmont Community College

Birmingham, Alabama
  Jefferson State College

New Orleans, Louisiana
  Delgado College

Oklahoma City, Oklahoma
  Oklahoma State University Technical Institute

Okmulgee, Oklahoma
  Okmulgee Technical Branch of Oklahoma State University

Stillwater, Oklahoma
  Oklahoma State Technical

Alvin, Texas
  Alvin Junior College

Amarillo, Texas
  Amarillo College

Dallas, Texas
  El Centro Junior College

Odessa, Texas
  Odessa College

Pasadena, Texas
  San Jacinto College

San Antonio, Texas
  San Antonio College

El Forado, Kansas
  Butler County Junior College

Kansas City, Kansas
  Kansas City, Kansas Community Junior College

Kansas City, Missouri
  Metropolitan Junior College

St. Louis, Missouri
  Florissant Community College

Chicago, Illinois
  Chicago City College (Loop Campus)

Junior/Community Colleges (continued)

- Chicago, Illinois (continued)
  - Chicago City College (Southeast Campus)
  - Chicago City Junior College (Wright Campus)

- Rockford, Illinois
  - Rock Valley Junior College

- Dearborn, Michigan
  - Henry Ford Community Junior College

- Grand Rapids, Michigan
  - Grand Rapids Junior College

- Lansing, Michigan
  - Lansing Community College

- Livonia, Michigan
  - Schoolcraft College

- University Center, Michigan
  - Delta College

- Cleveland, Ohio
  - Cuyahoga Community College

- Dayton, Ohio
  - Sinclair Community College

- Toledo, Ohio
  - University Community and Technical College

- Milwaukee, Wisconsin
  - Milwaukee Institute of Technology

- Phoenix, Arizona
  - Phoenix College

- Alta Loma, California
  - Chaffey College

- Azusa, California
  - Citrus College

- Chula Vista, California
  - Southwestern College

- Compton, California
  - Compton College

- Costa Mesa, California
  - Orange Coast College

- El Cajon, California
  - Grossmont College

- Fullerton, California
  - Fullerton Junior College

- Glendale, California
  - Glendale City College

- Hayward, California
  - Chabot Junior College

- Kentfield, California
  - College of Marin

- Long Beach, California
  - Long Beach City College

- Los Altos, California
  - Foothill Junior College

- Los Angeles, California
  - East Los Angeles College
  - Los Angeles City College

- Norwalk, California
  - Cerritos College

- Riverside, California
  - Riverside City College

- San Diego, California
  - San Diego Junior College

- San Pablo, California
  - Contra Costra Junior College

- Santa Barbara, California
  - Santa Barbara City College

- Santa Monica, California
  - Santa Monica City College

Junior/Community Colleges (continued)

Van Nuys, California
Los Angeles Valley College

Walnut, California
Mt. San Antonio College

Wilmington, California
Los Angeles Harbor College

Seattle, Washington
Highline Junior College

The following schools returned teacher questionnaires only:

High Schools

Lansing, Michigan
Eastern High School

Columbus, Ohio
Southwestern City Schools

Milwaukee, Wisconsin
Custer High School

Los Angeles, California
Los Angeles Adult Education

San Mateo, California
San Mateo High School

Vocational-Technical Schools

Philadelphia, Pennsylvania
Bok Technical High School

Rock Hill, Missouri
Special School District of St. Louis County

Vocational-Technical Schools (continued)

Cleveland, Ohio
Erie County Technical Institute

Junior/Community Colleges

Concord, California
Diablo Valley College

Los Angeles, California
Los Angeles Trade-Technical College

San Francisco, California
City College of San Francisco

Table C-5. Program Coverage--Titles of Data Processing Courses in Schools

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
INTRODUCTION TO DATA PROCESSING*				
Principles of D.P.			3	3
Fundamentals of D.P.	2	1	2	5
D.P.	6		1	7
D.P. Theory	3			3
D.P. I	8	1	1	10
D.P. I & II	1			1
D.P. I, II, & IV	3			3
Intro. to Business D.P.		1	4	5
Intro. to Automatic D.P.	2		1	3
Intro. to E.D.P.			2	2
Intro. to D.P. Systems		1		1
Intro. to D.P. I & Lab			1	1
Unit Record Equipment I		1	1	2
Unit Record Systems & Equip.			2	2
Business D.P. I	1			1
Intro. to Computers			1	1
Business Machines (Key Punch)	1			1
Punched Card Equipment I		1		1
IBM Card Punching		1		1
Card Punch	1	1		2
Prin. of Unit Record Systems		1		1
Prin. of Punched Card Acctg.		1		1
Basic Computing	1			1
Computer Programming I	1			1
Digital Technology Fundamentals	1			1
Electronics I			1	1
D.P. 11			1	1
D.P. 10			1	1
I A D.P.	1			1
D.P. Operations		1		1
E.D.P.	1		2	3
Survey of D.P.			1	1

*Classification used on questionnaire.

Table C-5 (continued)

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
Orientation to D.P.		1		1
Survey of Auto. D.P.			1	1
Prevocational D.P.	1			1
Computers & Their Uses			1	1
UNIT RECORD SYSTEMS & EQUIPMENT*				
Electro-mechanical Machines		1	5	6
Electronic D.P. Machines			2	2
Electric Acctg. Machines	1	1	2	4
Electronic Unit Record Equip.			1	1
Electronics II			1	1
Unit Record Equipment	1	2	6	9
Unit Record Machines	1			1
Unit Record Wiring			1	1
Unit Records I & II			3	3
Unit Record Equip. II & III		1	1	2
Unit Record of D.P.	1			1
Unit Record Machine Wiring			1	1
Unit Record Tabulators	1			1
Tab Equipment I & II		1		1
Punched Card Equip. II	2			2
Punched Card & Basic Wiring II		1	1	2
Basic Machine Wiring & Operations			1	1
Functional Wiring Principles		2	2	4
Basic Unit Record Lab		1		1
Basic Computer Concepts		1	1	2
Operation & Panel Wiring		1		1
Key Punch	1			1
Programming & Operating Punch Card Equipment			1	1
IBM Punched Card Machines		1		1
Principles of IBM Punch Card Acctg.			1	1
Intro. to Punched Card Machine Acctg.			2	2

*Classification used on questionnaire.

Table C-5 (continued)

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
Accounting--D.P. Lab	1			1
Intro. to Unit Record--Intermediate & Advanced			1	1
Computers & Their Use	1			1
Data Technology	1			1
Principles of D.P. & D.P. Machines			1	1
D.P. Machines Operation & Wiring			2	2
Systems & Equipment		1		1
Business D.P. II			1	1
D.P.		1	2	3
D.P. Operations		1		1
D.P. Equipment			2	2
D.P. Lab	1			1
Intro. to D.P. II & Lab			1	1
Intro. to D.P.	2			2
Pre D.P.	1			1
Vocational D.P. I & II	1			1
D.P. II	6			6
D.P. 11 & 12			1	1
D.P. 66A & 66B			1	1
INTRODUCTION TO SYSTEMS ANALYSIS*				
Systems Design			1	1
Systems Analysis	1	1	2	4
Systems Analysis & Design			1	1
Systems & Procedures	2		3	5
Systems I	1			1
Business Systems Design & Development		4		4
Business Systems Analysis & Design			1	1
Business Systems & Procedures		1		1
Business D.P. 2			1	1
Business 26--D.P. Systems			1	1
Data Systems Development & Design			6	6

*Classification used on questionnaire.

Table C-5 (continued)

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
Data Systems Development, Design & Fundamentals	1			1
D.P. Systems & Application I			1	1
D.P. Applications			1	1
D.P. III	1	1	1	3
Unit Record D.P. Applications			1	1
Acctg. Machine Operations I		1		1
Automated Acctg. Methods & Procedures			1	1
Basic Computer Systems		1		1
Computer Concepts & Programming			1	1
Programming Systems & Techniques		1		1
D.P. A			1	1
D.P. 12			1	1
DATA PROCESSING SYSTEMS*				
Intro. to Programming		1	2	3
Programming Systems		1		1
Basic Programming Concepts			1	1
Systems & Procedures			3	3
Systems Development & Design			3	3
Systems Development & Design Application I	1			1
Systems II	1			1
Systems Analysis & Development			1	1
Systems Implementations			1	1
Basic Computer Systems			1	1
Computer Systems		1		1
Computer Systems & Programming		1		1
Accounting Systems			1	1
Administrative Systems & Procedures			1	1
E.D.P. Systems			1	1
D.P. Systems & Applications II			1	1
General D.P. Systems			1	1
Applied Business Systems			1	1

*Classification used on questionnaire.

Table C-5 (Continued)

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
Acctg. Machine Operation II			1	1
Management of D.P. Installations			1	1
Applications Lab U.R.		1		1
COBOL			1	1
D.P.			1	1
D.P. Fundamentals			1	1
D.P. 12			1	1
D.P. 19			1	1
INTRODUCTION TO DIGITAL COMPUTERS (COMPUTER THEORY/LOGIC)*				
Basic Computer Concepts	1	1	2	4
Basic Computing Machines			3	3
Basic Computer Technology			1	1
Intro. to Computer Programming	1		1	2
Introduction to Programming			1	1
Introduction to Computers		1	1	2
Introduction to E.D.P.		1		1
Intro. to Electronic Computers		1		1
Computer Science			1	1
Computer Fundamentals		1		1
Digital Computer Theory			1	1
Principles of Computer Prog.			1	1
Programming I		1	1	2
Computer Programming I			1	1
Computer Programming I & II	1		1	2
Computer Programming III			1	1
			1	1
Adv. Computer Programming			1	1
Business Programming		1		1
D.P. Machines--UR Prog.			1	1
Math 6 Computer & D.P.			1	1
Programming (Autocoder)		1		1
D.P. 10			1	1
D.P. 13			1	1
D.P. I	1			1
D.P. Lab	1			1
Vocational D.P. II			1	1

*Classification used on questionnaire.

Table C-5 (Continued)

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
INTRODUCTION TO COMPUTER PROGRAMMING*				
Computer Programming I	1	11	14	26
Computer Programming III	1			1
Computer Programming	2	3	4	9
Advanced Computer Programming			3	3
Computer D.P. Concepts	2			2
Prin. of Computer Programming			2	2
Programming			5	5
Programming I & II			3	3
Programming Systems			3	3
COBOL Programming		1	1	1
Fortran Programming	1		3	4
Symbolic Programming			1	1
Business Programming			1	1
Computer Prog. for Business			3	3
Prog. Business Computer I			1	1
1401 Programming			1	1
Basic 1440 Programming			1	1
1620 Programming		1		1
Intro. to Programming Systems			3	3
Intro. to Computer Programming		1		1
Intro. to Electronic Computers			1	1
Electronic Computer Programming			2	2
Fundamentals of Computer Prog.			1	1
Basic Computer Programming			2	2
Computer Operations		1		1
Computer Math	1			1
Computer Technology	1			1
Data Systems I		1		1
Vocational D.P. II			1	1
D.P. II		1		1
D.P. Lab	1			1
Business D.P. 23		1		1

*Classification used on questionnaire.

Table C-5 (Continued)

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
D.P. 13			1	1
D.P. 17 A		1		1
ADVANCED PROGRAMMING*				
Computer Programming I			1	1
Computer Programming			4	4
Computer Programming II	1	1	12	14
Computer Programming III		1		1
Computer Programming I,II,III			1	1
Computer Programming II,III	1		1	2
Computer Programming III,IV	1	1		2
Computer Concepts			1	1
Computer Compiler Languages			1	1
Computer Programming 4B			1	1
Computer Programming Scientific & Commercial			1	1
Programming Bus. Computer II			1	1
Programming Systems			1	1
Programming Systems Fortran			1	1
Programming (Fortran)		1		1
Programming II		1	2	3
Programming III			1	1
Scientific Programming		1	1	2
Scientific Programming II			1	1
Intermediate Computer Programming			1	1
Advanced Programming Systems		1	1	2
Advanced 1440 Programming			2	2
Advanced Programming Topics			1	1
Advanced Computer Programming		1	1	2
Advanced Computing and Programming Systems	1			1
Advanced Prog. System Techniques			1	1
Advanced Wiring			1	1

*Classification used on questionnaire.

Table C-5 (Continued)

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
Commercial Programming			1	1
Bus. Computer Prog. Applications			1	1
Individual D.P. Projects			1	1
Systems & Large Projects			1	1
Autocoder Computer Programming	1			1
COBOL Programs			1	1
D.P. Methods			1	1
D.P. II	1			1
S.P.S. 1401			1	1
D.P. 21,22			1	1
D.P. 17B			1	1
D.P. 3		1		1
D.P. Lab	1			1
Bus. 83-3			1	1
B.D.P. 25, 27, 51, 52			1	1
B.D.P. 25 (COBOL Prog.)			1	1
PROGRAMMING SYSTEMS*				
Computer Programming Systems I			1	1
Computer Programming II	1	1	1	3
Computer Programming I, II, III			1	1
Computer Programming 1620,1400,360			1	1
Programming Systems I & II			1	1
Programming Systems I	1		1	2
Programming Systems II		1		1
Programming Systems			1	1
Programming III			4	4
Programming Linear			1	1
Adv. Computer Prog. & Systems			1	1
Adv. Computer Programming			4	4
Adv. Programming Systems	1			1
Adv. Programming Language			1	1
Adv. Programming			1	1
Adv. Prog. Systems I & II			1	1

*Classification used on questionnaire.

Table C-5 (Continued)

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
Intro. to Scientific Programming		1		1
Scientific Programming			1	1
Systems & Procedures			1	1
Systems Development & Design		1		1
Systems Development and Design Applications II	1			1
Systems Development & Design I, II			1	1
Systems I & II		1		1
Information Processing Systems and Their Uses			1	1
Business Systems & Procedures			1	1
Business D.P.			1	1
D.P. Systems		1		1
D.P. Lab	1			1
D.P. 19B			1	1
D.P. 21 & 22			1	1
D.P. 4		1		1
B.D.P. 58 IBM 360 Systems			1	1
Executive I.O.C.S.		1		1
Introduction to COBOL		1		1
DATA PROCESSING APPLICATIONS*				
D.P. Applications I	1			1
Applications I & II		2		2
Computer Applications			2	2
Computer Projects		1	1	2
Computer Business Problems			1	1
D.P. Applications Lab			1	1
Processing Applications			1	1
Punched Card Applications		1		1
Prog. for Bus. Applications			1	1
Bus. Applications for Electronic Computer			1	1
Business Computer Programming			1	1
Problems in Computer D.P.			1	1

*Classification used on questionnaire

Table C-5 (Continued)

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
Special Problems in Bus. D.P.			1	1
D.P. Problems			1	1
Survey of D.P. & Applications			1	1
Case Study			1	1
Case Study & System Selection		1		1
Field Work			1	1
Research Project		1		1
Internship			1	1
Installation Management			1	1
Automated Accounting			1	1
Programming Monitor Systems			1	1
Fortran		2		2
Adv. Computer Programming			1	1
Adv. Concepts & Systems Analysis			1	1
D.P. II	1			1
D.P. 17 & 19			1	1
D.P. 22			1	1
D.P. 3 & 4		1		1
FIELD WORK IN DATA PROCESSING*				
D.P. Field Project	1	3	7	11
D.P. Programming Project			1	1
Business Research Project			1	1
Intro. to Field Project and Adv. Field Project	1			1
Computer Project or Field Project		1		1
Computer Work Study			1	1
On-the-job Training		1		1
Work Experience			1	1
Cooperative D.P. Internship			1	1
Internship			1	1
Cooperative Program	1		3	4
D.C.E.		1		1
Case Study of System Selection		1	1	2
Admin. Systems & Procedures			1	1

*Classification used on questionnaire.

Table C-5 (Continued)

Titles of data processing courses in schools	High School	Voc. Tech.	Junior College	Total
D.P. Supervisor			1	1
Computer to Decision Making			1	1
D.P. 23			1	1
D.P. II			1	1
DATA PROCESSING MATHEMATICS*				
D.P. Math I, II & III	1	1		2
D.P. Math I & II		2	1	3
Statistics		1	2	3
Computer Math			1	1
Mathematics for Computers			2	2
Advanced Math			1	1
Technical Math			1	1
Applied Data Math			1	1
Modern Math			1	1
Business Math I		1		1
Numbering Systems		1		1
Intro. to Digital Computers			1	1
General Electricity		1		1
Math 10 (Algebra for Business with Applications for D.P. Math)			1	1
Data Presentation			1	1
D.P. Supervision			1	1
Math 40			1	1
D.P. 16			1	1
84 1 & 2			1	1
85.0			1	1
D.P. II	1			1

*Classification used on questionnaire.

Appendix C, Table C-6. Skills and Knowledges Applied in High School and Post High School Data Processing Courses

Skills and Knowledges	Data Processing Courses																					
	Intro. to D.P.		Unit Rec. Sys.-Eqpt.		Intro. to Sys.		D.P. Systems		Intro.to Dig.Comp.		Intro.to Comp.Prog.		Adv. Prog.		Prog. Systems		D.P. Applic.		Field Work-D.P.		D.P. Math	
	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS
Oper. key punch	26	25	20	64		1		2	1		5	10		3		1	17	1				1
Oper. sorter	21	22	20	66		1		2			4	7		3		1	16	2				1
Oper. collator	15	17	14	62		1		2			3	5		2			14	2				
Oper. reproducer	16	16	16	64		1		2			3	6		3		1	15	2				1
Oper. acctg. machine	20	17	20	63		3		3		1	2	6		3		1	15	4				1
Card layout & design	20	27	16	48		11	1	8	1	3	6	11		3		2	17	7	2	1		2
Design forms	9	8	14	29	1	21		14	1	2	6	11		7	1	4	10	8	2	2		1
Flow charting	17	21	10	25	2	14		10	4	12	7	36		12	1	6	14	9	2	1		2
Work load evaluation	4	2	7	15	3	17		14	1	3	3	7		5	1	4	4	7		1		2
Coding & condensing	9	20	7	19		11		10	2	13	8	30		11	1	3	11	6	1			1
FORTRAN	2			1			1		2	4	9	26	3	38	1	12	7	5				1
COBOL	1		1		1			1		3	5	13	4	36	1	17	5	4				3
Autocoder	3	3	1			2			2	4	3	30	3	25	2	3	5	2		3		2
Machine language	5	11	3			3		3	4	14	9	62		13	1	3	7	3				
Block diagramming	5	17	2	9		10		10	3	17	8	49	1	12	1	5	7	8	1	1		2
Maintain prog. libr.					1	1		7	1	1	5	15		22	2	12	1	3		2		1
Maintain mag. tape libr.				1	1	1		4	1	1	2	11		14	2	11	1	2		3		1
Prog. instructions	8	10	2	1		1		3	4	9	8	52		21	1	7	8	1		3		1
Other languages	1		2					1	1	1	6	22	3	22	4	13	5	3		1		1
Plan & punch prog. card	22	28	17	54		1		2	1	3	5	9		2	1	1	16	1		1		1

Table C-6 (Continued)

Skills and Knowledges	Data Processing Courses																					
	Intro. to D.P.		Unit Rec. Sys.-Eqpt.		Intro. to Sys.		D.P. Systems		Intro.to Dig.Comp.		Intro.to Comp.Prog.		Adv. Prog.		Prog. Systems		D.P. Applic.		Field Work-D.P.		D.P. Math	
	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS
Wire collator panel	10	11	12	60		2		2	1		2	2			1		12	2				
Wire reproducer panel	12	12	14	61		2		2			2	2			1		14	3				
Wire acctg. mach. panel	14	13	18	67		2		2	1	1	1	3			1		13	3				
Oper. computer	5	12	1	2		1		2	5	17	10	62		23	1	7	5	4		2		1
Oper. card processor	5	6	1	6		1		1	5	10	7	34		16	2	5	4	2		2		1
Computer applications	5	4	1	1	2	8		10	4	6	9	35	2	14	2	11	6	21	1	4		2
Loops & indexing	4	4	2		1	2		2	4	13	8	56	4	36	1	8	8	7		2		
Subroutines	4	4	1		2	1		2	4	11	7	52	5	40	2	11	6	7		2		1
Input-output controls	4	4	2	1	1	3		4	4	10	8	50		33	1	12	6	5		2		
Prog. a tape system	4	1				1	1	2	2	2	3	20	2	31	2	10		5		2		2
Job timing	1	2	3	9	1	8		8	1	5	2	17	2	21	2	8	5	5		1		1
Prog. random access dev.	3	1							3	6	4	21	3	45	2	10	1	7		4		1
Debug programs	7	7	2	2		1		2	3	12	9	63	3	38	3	17	8	6		3		2
Sort-merge programming	4	1	1	2		1			1	3	2	18	3	38	2	19	7	7		1		3

Appendix C, Table C-7. Concepts - Discussion and Presentations About

Concepts	Data Processing Courses																					
	Intro. to D.P.		Unit Rec. Sys.-Eqpt.		Intro. to Sys.		D.P. Systems		Intro.to Dig.Comp.		Intro.to Comp.Prog.		Adv. Prog.		Prog. Systems		D.P. Applic.		Field Work-D.P.		D.P. Math	
	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS
Functions of key punch	30	57	16	54				1	1	1		4					14					
Functions of sorter	30	55	16	55				1			1	1					14					
Functions of collator	29	52	13	58				1	1			1					15					
Functions of reproducer	29	50	16	58				1			1	1					14					
Functions-acctg. machine	30	48	17	58		2		3	1		1	1					14	1				
Overview-unit rec. sys.	34	59	11	38		3		1	1	1		5					12	4				
History D.P.	34	76	7	20				2	1	8	3	7					13					
Card layout & design	29	50	13	41	1	10	1	7	3	4	3	11					14	5	2	1		
Forms design	21	26	16	35	2	16	1	13		2	5	10		2	2	4	14	8	2	1		
Procedures development	18	22	7	18	2	22	2	17	1	2	3	12	1	3	2	6	10	8	1	1		1
Flow charting	23	40	9	29	4	15	2	9	4	12	7	33	1	5	1	5	12	4	1			1
Purp.&func. languages	14	32	3	4	2	3	1	4	5	16	9	33	1	19	4	9	9	4				1
Assembly prog. & compilers	8	11	3	2	2	1	1	3	3	11	7	47	2	21	4	9	8	5				
Macro-generators	1	4	1	3		2		2	3	6	5	26	3	31	4	12	6	6				
Report generators	1	5	2	2		3		3	1	8	4	26	2	27	5	14	3	6		1		1
Data scheduling systems	5	3	3	3	1	10		12	1	2	3	5	3	11	4	11	6	3		2		3
Monitors& high level lang.		2	1			2		1	2	3	4	12	2	39	5	23	5	8				2
Anal. of info. systems	5	8	2	2	2	16	1	13		1	2	6	2	11	2	12	2	4		3		1
Computer equipment	20	46	3	9	1	4	2	5	5	21	9	30	2	10	1	7	10	3				1
Coding & condensing data	14	23	7	16	1	11	1	15	5	9	9	32	1	10	1	4	9	7	1			

Table C-7 (Continued)

Concepts	Data Processing Courses																					
	Intro. to D.P.		Unit Rec. Sys.-Eqpt.		Intro. to Sys.		D.P. Systems		Intro.to Dig.Comp.		Intro.to Comp.Prog.		Adv. Prog.		Prog. Systems		D.P. Applic.		Field Work-D.P.		D.P. Math	
	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS	HS	PHS
Eval. of auxiliary eqpt.	7	18	5	8	2	12	1	16	2	6	4	12		4	1	8	6	7	1			1
Boolean algebra	2	14	2			1	1		2	5	5	9	1	4	1	2	3	1			5	39
Logic	7	17	4	2		1	1	1	2	9	5	15		7	1	5	8	2			4	27
Fixed & floating points	4	9	2	3		1	1		2	10	4	28	1	18	1	8	9	2			1	16
Prin.&theory-dig. comp.	10	36	3	2		2		3	4	25	6	26		4	1	3	8	3				2
Number systems	14	35	4	5		2		1	2	14	6	17		1	1	2	11	1			3	27
Computer logic	13	31	3	5		4		3	4	20	6	36		10	1	3	10	2				10
Programming essentials	11	22	3	1	1	2	2	5	5	13	10	56		19	1	9	8	3				2
Block diagramming	15	36	4	11	3	11	1	7	5	14	9	43	1	11	1	8	10	4				1
Programming systems	8	11	2	2		8	1	18	2	9	6	31	2	17	4	20	8	4		1		
Central processing unit	18	42	3	5		1		5	5	28	7	29	1	7	1	4	9	2				
Registers	8	25	2	5		1		3	3	24	7	38	2	12	2	6	7	3				1
Uses of symbolic lang.	8	22	3	4	2	1	1	3	6	14	8	49	3	14	2	8	8	6				
Computer applications	14	26	4	1		9	1	14	4	8	7	31	4	19	2	17	9	22	1	6		1
Principles of D.P.	22	70	7	19	1	3	1	3	3	11	5	13	1	5	1	2	11	3	1		1	

Appendix C, Table C-8. Computer Equipment in Total Public Schools

Equipment	High Schools N = 710	Post High Schools N = 337
Key punch simulator	1,704	546
Key punch	1,556	1,248
Verifier	289	282
Sorter	545	355
Reproducer	299	266
Interpreter	209	222
Collator	256	269
Accounting machine	480	328
Computer	181	265

APPENDIX D

TEXTBOOKS USED IN DATA PROCESSING COURSES

High School	Voc-Tech	Junior College	Text
	X		Agnew, PRACTICAL BUSINESS ENGLISH FOR COLLEGE, South-Western.
	X		Agnew, OFFICE MACHINES COURSE, South-Western.
		X	Alderson and Shapiro, MARKETING AND THE COMPUTER, Prentice-Hall.
X	X		Anderson, BASIC COMPUTER PROGRAMMING, Appleton-Century Crofts.
X	X	X	Arnold and others, INTRODUCTION TO DATA PROCESSING, John Wiley & Sons.
X	X	X	Awad, BUSINESS DATA PROCESSING, Prentice-Hall.
X			Bartee, DIGITAL COMPUTER FUNDAMENTALS, McGraw-Hill.
	X		Beach and Clark, PSYCHOLOGY IN BUSINESS, McGraw-Hill.
	X		Beighey and Borchardt, MATHEMATICS FOR BUSINESS, McGraw-Hill.
X	X		Bell, A MANAGEMENT GUIDE TO ELECTRONIC COMPUTERS, McGraw-Hill.
	X		Bender, HOW TO TALK WELL, McGraw-Hill.
		X	Berkeley and Wainwright, COMPUTERS, THEIR OPERATIONS AND APPLICATIONS, Reinhold.
		X	Borko, COMPUTER APPLICATIONS IN THE BEHAVIORAL SCIENCES, Prentice-Hall.
X			Boulding and Spivey, LINEAR PROGRAMMING AND THE THEORY OF THE FIRM, Macmillan.
	X		Brandon, MANAGEMENT STANDARDS FOR DATA PROCESSING, D. Van Nostrand.

High School	Voc-Tech	Junior College	Text
		X	Brooks and Iverson, AUTOMATIC DATA PROCESSING, John Wiley & Sons.
X	X		Bux, KEY PUNCH TRAINING COURSE & KIT, South-Western.
	X		Bux, SORTER & TABULATOR TRAINING COURSE & KIT, South-Western.
X	X		Canning, ELECTRONIC DATA PROCESSING FOR BUSINESS AND INDUSTRY, John Wiley & Sons.
X			Chace, Schniedika, Sherwood, PRINCIPLES OF COST ACCOUNTING, South-Western.
X	X	X	Chapin, AN INTRODUCTION TO AUTOMATIC COMPUTERS, D. Van Nostrand.
X			Corliss, COMPUTERS, Atomic Energy Commission.
X			Corvine and Abrams, BASIC DATA PROCESSING, Holt, Rinehart & Winston.
X		X	Crowder, THE ARITHMETIC OF COMPUTERS, Doubleday.
	X		Cutler, INTRODUCTION TO COMPUTER PROGRAMMING, Prentice-Hall.
X			Darnowski, COMPUTERS THEORY AND USES, NEA.
	X	X	Data Processing Management Association, AUTOMATIC DATA PROCESSING: PRINCIPLES AND PROCEDURES, Prentice-Hall.
X	X	X	Davis, AN INTRODUCTION TO ELECTRONIC COMPUTERS, McGraw-Hill.
X			Desmonde, COMPUTERS AND THEIR USES, Prentice-Hall.
X		X	Dodes, IBM 1620 PROGRAMMING FOR SCIENCE AND MATH, Hayden.

High School	Voc-Tech	Junior College	Text
	X		Dubois, ESSENTIAL METHODS IN BUSINESS STATISTICS, McGraw-Hill.
	X	X	Durestock, WIRING THE 557, 519, 409, William C. Brown.
X	X		Elliott and Wasley, BUSINESS INFORMATION PROCESSING SYSTEMS, Richard D. Irwin.
		X	Fairbanks, SUCCESSFUL OFFICE AUTOMATION, Prentice-Hall.
		X	Finney and Miller, PRINCIPLES OF ACCOUNTING, Prentice-Hall.
X	X	X	Fisher and Swindle, COMPUTER PROGRAMMING SYSTEMS, Holt, Rinehart & Winston.
	X		Fletcher and Cashman, INTRODUCTION TO IBM SYSTEMS 1360 PROGRAMMING, Anaheim.
		X	Freeberger and Prager, APPLICATIONS OF DIGITAL COMPUTERS, Ginn & Co.
	X		Fruend and Williams, MODERN BUSINESS STATISTICS, Prentice-Hall.
		X	Gentle, DATA COMMUNICATIONS IN BUSINESS, Publishers Service Co.
X		X	Germain, PROGRAMMING THE IBM 1620, Prentice-Hall.
	X		Gibbs and Webster, GUIDE AND HANDBOOK FOR WRITING, American Book Co.
	X	X	Gillie, BINARY ARITHMETIC AND BOOLEAN ALGEBRA, McGraw-Hill.
X		X	Gotlieb and Hume, HIGH SCHOOL DATA PROCESSING, McGraw-Hill.
X			Grabbe, Ramo and Wooldridge, CONTROL FUNDAMENTALS, VOLUME 1, OF HANDBOOK OF AUTOMATION, John Wiley & Sons.

High School	Voc-Tech	Junior College	Text
		X	Greenberger, COMPUTERS AND THE WORLD OF THE FUTURE, MIT Press.
X	X	X	Gregory and Van Horn, AUTOMATIC DATA PROCESSING SYSTEMS, Wadsworth.
X	X	X	Gregory and Van Horn, BUSINESS DATA PROCESSING AND PROGRAMMING, Wadsworth.
X			Gruenberger and Jaffray, PROBLEMS FOR COMPUTER SOLUTION, John Wiley & Sons.
X	X		Haga, UNDERSTANDING AUTOMATION, The Business Press.
	X	X	Hartkemeir, INTRODUCTION TO DATA PROCESSING, John Wiley & Sons.
	X	X	Harwell, TECHNICAL COMMUNICATION, Macmillan.
		X	Head, REAL-TIME BUSINESS SYSTEMS, Holt, Rinehart & Winston.
X		X	Hein, INTRODUCTION TO ELECTRONIC DATA PROCESSING, D. Van Nostrand.
	X		Hemmerling, ELEMENTARY MATHEMATICS, McGraw-Hill.
	X		Hoag, COMPREHENSIVE FORTRAN PROGRAMMING, Hayden.
X	X	X	Inman, FUNDAMENTALS OF ELECTRONIC DATA PROCESSING: A PROGRAMMED TEXT, Prentice-Hall.
	X		Jacabowitz, COMPUTER ARITHMETIC, Rider.
X			Jeenel, PROGRAMMING FOR DIGITAL COMPUTERS, McGraw-Hill.
X			Johnson, ACCOUNTING SYSTEMS, McGraw-Hill.
		X	Johnson, Kast and Rosenweig, THEORY AND MANAGEMENT OF SYSTEMS, McGraw-Hill.

High School	Voc-Tech	Junior College	Text
X	X	X	Kahn, BUSINESS DATA PROCESSING: BASIC PRINCIPLES AND APPLICATIONS, McGraw-Hill.
		X	Kemey, Snell, and Thompson, INTRODUCTION TO FINITE MATH, Prentice-Hall.
		X	Kent and Taulbee, ELECTRONIC INFORMATION HANDLING, Spartan Books.
		X	Kovach, COMPUTER-ORIENTED MATHEMATICS, Holden-Day.
X			Kozmetsky and Kircher, ELECTRONIC COMPUTERS AND MANAGEMENT CONTROL, McGraw-Hill.
	X		Kuo, NUMERICAL METHODS AND COMPUTERS, Addison-Wesley.
X	X	X	Laden and Gildersleeve, SYSTEMS DESIGN FOR COMPUTER APPLICATIONS, John Wiley & Sons.
X			Laird and Laird, PRACTICAL BUSINESS PSYCHOLOGY, McGraw-Hill.
X			Larsen, OPERATOR TRAINING COURSE FOR 024-026 IBM CARD PUNCH, William Marsh.
X	X	X	Laurie, COMPUTERS AND COMPUTER LANGUAGES, South-Western.
X	X	X	Laurie, COMPUTERS AND HOW THEY WORK, South-Western.
X	X	X	Lazzaro, SYSTEMS AND PROCEDURES: A HANDBOOK FOR BUSINESS AND INDUSTRY, Prentice-Hall.
X			Leadey, FORTRAN PROGRAMMING, McGraw-Hill.
X	X	X	Leeds and Weinberg, COMPUTER PROGRAMMING FUNDAMENTALS, McGraw-Hill.
X	X	X	Leeson and Dimitry, BASIC PROGRAMMING CONCEPTS OF THE IBM 1620 COMPUTER, Holt, Rinehart & Winston.

High School	Voc-Tech	Junior College	Text
	X		Levin and Kirkpatrick, QUANTITATIVE APPROACHES TO MANAGEMENT, McGraw-Hill.
	X	X	Loomba, LINEAR PROGRAMMING, McGraw-Hill.
		X	Markowitz, Hausner and Karr, SUNSCRIPT, Prentice-Hall.
	X	X	Martin, ELECTRONIC DATA PROCESSING: AN INTRODUCTION, Richard D. Irwin.
		X	Martin, PROGRAMMING REAL TIME COMPUTER SYSTEMS, Prentice-Hall.
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TITLE

Curricular Implications of Automated Data Processing for Educational Institutions

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ABSTRACT

The problem was primarily concerned with (1) an analysis of integrated data processing training programs in public education institutions; (2) a study of employees in the integrated data processing programs in selected business offices, as well as a study of needs as expressed by the data processing management personnel of these offices, to determine the common body of knowledge needed for entry into, adjustment to, and promotion patterns for seven major data processing job categories; and (3) the determination of new and projected developments in data processing as forecasted by manufacturers and users of hardware and software and the influence of such developments on future job opportunities and training programs.

Interviews were held in 353 businesses using data processing and the employees of those companies completed questionnaires. Teachers in 176 schools were interviewed to analyze the types of data processing programs being offered in the public high schools and two-year post high schools in the United States. Interviews were held with advance planning executives in computer manufacturing companies to determine what plans were being made for the next three to seven years that would affect education for data processing positions.

Curriculums for the high school and two-year post high school levels were recommended.